

## CULICOIDES (DIPTERA: CERATOPOGONIDAE) SPECIES IN SOUTHEASTERN NEBRASKA

CAROL D. PAPPAS AND LARRY G. PAPPAS

*Department of Science and Technology, Peru State College, Peru, NE 68421*

**ABSTRACT.** Twenty-four species of *Culicoides* were collected between April and September of 1986 from Nemaha and Richardson counties of southeastern Nebraska using New Jersey light traps and tree hole sampling. Light trap samples were dominated by *C. crepuscularis* (42.4%), *C. stellifer* (29.6%), *C. haematopodus* (17.4%), *C. variipennis* (4.1%) and *C. obsoletus* (2.8%). *Culicoides guttipennis* and *C. villosipennis* were the most common of the 9 tree hole species collected. New state records for Nebraska were obtained for *C. lahillei*, *C. riggsi*, *C. footei*, *C. paraensis*, *C. nanus*, *C. spinosus*, *C. biguttatus* and *C. piliferus*.

### INTRODUCTION

Approximately 20 species of *Culicoides* Latreille (Diptera: Ceratopogonidae) are thought to occur in Nebraska (Blanton and Wirth 1979, Wirth et al. 1985), representing both eastern and western North America. Although collections of *Culicoides* have previously been made in Nebraska, no systematic attempts have been made to examine species diversity or seasonality within the various ecological subunits comprising Nebraska. Nebraska spans an ecological gradient from remnants of the deciduous forest in southeastern Nebraska to the western short grass prairie. The following study was initiated to develop an understanding of species composition in one of the ecological subunits of Nebraska, the eastern deciduous forest, in the southeastern corner of the state. In addition to the ecological considerations, a recent outbreak of epizootic hemorrhagic disease in Nebraska deer populations focuses interest on the *Culicoides* populations which may vector this disease.

### MATERIALS AND METHODS

Two methods were used to collect *Culicoides* in Nemaha and Richardson counties of southeastern Nebraska. Four New Jersey light traps were stationed near upland forests along the Missouri river (3 in Nemaha County; one in Richardson County), one at a pig farm on the Missouri River flood plain (Nemaha County) and one at a dairy farm (Richardson County). Light traps were run at approximately weekly intervals from April 28 to September 20, 1986, for a total of 180 trap/nights. Females from light traps were assessed for parity (Dyce 1969, Potter and Akey 1978, Mullens and Schmidtman 1982) and blood feeding. Tree holes were sampled at 2 locations (Nemaha and Richardson counties). Water and organic material were removed from tree holes and returned to the laboratory where samples were placed in styrofoam

cups covered with plastic lids. Specimens collected with both sampling methods were mounted on slides (Wirth and Marston 1968) for identification (Blanton and Wirth 1979, Wirth et al. 1985). Representatives of all species have been deposited in the Nebraska State Museum, University of Nebraska-Lincoln.

### RESULTS

Twenty-three species were identified in the 22,546 specimens collected with New Jersey light traps. Nine species made up the majority of these collections (Table 1). *Culicoides crepuscularis* Malloch, *C. stellifer* (Coquillett) and *C. haematopodus* Malloch composed 89.4% of the total specimens collected. *Culicoides crepuscularis* had an early season peak with 35.5% of this species collected between April 28 and June 2, 1986, followed by smaller peaks of 9.8% on July 21 and 18.9% on August 31. This pattern was also followed by *C. haematopodus*, which had maximum catches of 35.9% on May 13 and 16.2% on August 31. *Culicoides stellifer* was collected beginning on May 13 with a peak collection of 15.6% (August 24) and 54.6% (August 31). *Culicoides variipennis* (Coquillett) had a single peak collection of 64.8% on July 14, and *C. obsoletus* (Meigen) peaked on July 28 (13.9%) and August 31, 1986 (35.9%). *Culicoides venustus* Hoffman had 2 late season peaks on July 28 (17.8%) and August 31 (32.7%). *Culicoides guttipennis* (Coquillett) was most abundant on May 13 (11.7%), July 7 (24.9%) and July 28, 1986 (21.7%). *Culicoides sanguisuga* (Coquillett) peaked on June 23 (26.2%) and August 31, 1986 (27.4%). Of the 5 most commonly collected species (Table 1), the parous rates varied from 8.1% in *C. haematopodus* to 40.9% in *C. obsoletus*. Blood fed percentages for the 5 most commonly collected species (Table 1) were similar, ranging from 0.4% in *C. obsoletus* to 1.7% in *C. crepuscularis*.

Those less frequently collected species (number collected) also demonstrated some season-

ality. *Culicoides travisi* Vargas (43) and *C. riggsi* Khalaf (3) were collected only in early summer between May 13 and June 12, 1986. *Culicoides piliferus* Root and Hoffman (8), *C. biguttatus* (Coquillett) (2), *C. hinmani* Khalaf (1), *C. spinosus* Root and Hoffman (7), *C. nanus* Root and Hoffman (1), *C. footei* Wirth and Jones (2) and *Culicoides* n. sp. 1 Pappas and Pappas (to be described elsewhere) (39) were collected in mid-summer between June 12 and July 7, 1986. *Culicoides lahillei* (Iches) (4) (synonym: *C. debilipalpis* Lutz) was collected in late summer between June 7 and August 31, 1986. *Culicoides bergi* Cochrane (4) was collected on May 13 and July 14, 1986, while *Culicoides arboricola* Root and Hoffman (25) was collected periodically throughout the summer. Three females of the *Selfia* species were collected during the early spring and could not be identified to species. Also, one specimen of *C. stonei* James was trapped in midsummer.

Samples were taken from 131 tree holes in Nemaha and Richardson counties. Eight species were collected in these samples (Table 2). *Culicoides guttipennis* (87.0%) and *C. villosipennis* Root and Hoffman (8.8%) were the most com-

mon with 90.5% of these 2 species being taken from the most common hole-producing tree species, red oak (*Quercus rubra*) and chinquapin oak (*Quercus muhlenbergii*). These oak species primarily form tree holes which support standing water throughout most of the summer. The other *Culicoides* species taken from tree holes were more commonly taken from tree holes which did not support standing water, but contained moist decaying organic material. These tree species included the slippery elm (*Ulmus rubra*), American linden (*Tilia americana*) and bitternut hickory (*Carya cordiformis*). *Culicoides paraensis* (Goeldi) was taken from tree holes (Table 2), but not in the New Jersey light trap collections. Additionally, *C. lahillei*, a known tree hole breeder, was taken with New Jersey light traps but not from tree hole samples, which brings the total tree hole breeding species to nine.

## DISCUSSION

Twenty-four species were collected in southeastern Nebraska with New Jersey light traps and tree hole sampling. The majority of these

Table 1. *Culicoides* species taken with New Jersey light traps in Nemaha and Richardson counties of Nebraska.

Species	Males	Females	Parous	Blood fed
<i>C. crepuscularis</i>	2,088	7,482	883	124
<i>C. stellifer</i>	1,031	5,639	1,106	74
<i>C. haematopotus</i>	504	3,416	277	42
<i>C. variipennis</i>	95	819	59	13
<i>C. obsoletus</i>	25	613	251	3
<i>C. guttipennis</i>	121	127	15	5
<i>C. venustus</i>	8	223	12	1
<i>C. villosipennis</i>	7	109	5	7
<i>C. sanguisuga</i>	3	94	10	0

Table 2. Tree hole *Culicoides* collected in Nemaha and Richardson counties of Nebraska.

Tree species	n	Number of <i>Culicoides</i> reared from tree holes							n. sp.	footei
		<i>guttipennis</i>	<i>villosipennis</i>	<i>hinmani</i>	<i>paraensis</i>	<i>arboricola</i>	<i>nanus</i>	1		
Red oak	65	1,039	76	0	3	4	0	1	0	
Chinquapin oak	38	848	116	0	0	0	0	0	0	
Green ash	7	74	9	0	1	0	0	0	0	
Slippery elm	4	10	0	1	0	0	1	0	0	
Shagbark hickory	4	33	0	0	0	0	0	0	0	
American linden	4	14	0	48	38	1	1	0	1	
Bur oak	3	10	7	0	0	0	0	0	0	
Hackberry	2	25	0	0	0	0	0	0	0	
Black walnut	1	27	0	0	0	0	0	0	0	
Bitternut hickory	1	0	0	0	0	1	0	1	0	
Black oak	1	6	1	0	0	0	0	0	0	
Catalpa	1	0	1	0	0	0	0	0	0	

species are known residents of eastern North America with several new distributional records (Blanton and Wirth 1979, Wirth et al. 1985). Interesting records include (nearest previous state record) *Culicoides lahillei* and *C. footei* (Kentucky), *C. riggsi* (Oklahoma), *C. piliferus*, *C. paraensis* and *C. nanus* (Missouri); *C. spinosus* (Illinois) and *C. biguttatus* (Iowa). The one western species, *C. stonei*, was previously known to extend only into western Nebraska. This species was taken at a pig farm on the Missouri River floodplain. There are similarities in species composition with Missouri, although Childers and Wingo (1968) collected *C. oklahomensis* Khalaf and *C. scanloni* Wirth and Hubert that were not present in our study. Additionally, collections in Iowa (Wayne Rowley, personal communication) contain *C. alexanderi* Wirth and Hubert and *C. denticulatus* Wirth and Hubert which we did not collect in southeastern Nebraska.

One of the species collected in our study, *C. variipennis*, is known to transmit blue tongue virus (Walton et al. 1984) and epizootic haemorrhagic disease (Jones et al. 1977). Two other species taken, *Culicoides venustus* and *C. stellifer*, may also be implicated in blue tongue virus transmission (Jones et al. 1977, 1983).

#### ACKNOWLEDGMENTS

We thank Willis W. Wirth for confirming the identification of species in our study, for reviewing our manuscript and for his continued interest in *Culicoides* research. We also thank Wayne L. Kramer for supplying New Jersey light traps for this study and his interest in our research.

#### REFERENCES CITED

- Blanton, F. S. and W. W. Wirth. 1979. Arthropods of Florida and neighboring land areas. Vol. 10. The sand flies (*Culicoides*) of Florida. Florida Department of Agriculture and Consumer Services. 204 pp.
- Childers, C. C. and C. W. Wingo. 1968. Genus *Culicoides* (Diptera: Ceratopogonidae) in central Missouri: species, seasonal abundance, activity. Mo. Agric. Exp. Stn. Res. Bull. 934:2-32.
- Dyce, A. L. 1969. The recognition of nulliparous and parous *Culicoides* (Diptera: Ceratopogonidae) without dissection. J. Aust. Entomol. Soc. 8:11-15.
- Jones, R. H., R. D. Roughton, N. M. Foster and B. M. Bando. 1977. *Culicoides*, the vector of epizootic hemorrhagic disease in white-tailed deer in Kentucky in 1971. J. Wildl. Dis. 13:2-8.
- Jones R. H., E. T. Schmidtman and R. M. Foster. 1983. Vector-competence studies for bluetongue and epizootic hemorrhagic disease viruses with *Culicoides venustus* (Ceratopogonidae). Mosq. News 43:184-186.
- Mullens, B. A. and E. T. Schmidtman. 1982. The gonotrophic cycle of *Culicoides variipennis* (Diptera: Ceratopogonidae) and its implications in age-graduating field populations in New York State, USA. J. Med. Entomol. 19:340-349.
- Potter, H. W. and D. H. Akey. 1978. Pigmentation associated with oogenesis in the biting midge *Culicoides variipennis*: changes in abdominal tergite patterns. Mosq. News 38:499-504.
- Walton, T. E., T. L. Barber, R. H. Jones and A. J. Luedke. 1984. Epizootiology of blue tongue virus: transmission cycle, vectors, and serotypic distribution in the Americas. Prev. Vet. Med. 2:379-388.
- Wirth, W. W., A. L. Dyce and B. V. Peterson. 1985. An atlas of wing photographs, with a summary of the numerical characters of the Nearctic species of *Culicoides* (Diptera: Ceratopogonidae). Contrib. Am. Entomol. Inst. (Ann Arbor) 22(4):1-46.
- Wirth, W. W. and N. Marston. 1968. A method for mounting small insects on microscope slides in Canada balsam. Ann. Entomol. Soc. Am. 61:783-784.