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A TAXONOMIC CHECKLIST OF THE MOSQUITOES OF MONTANA WITH NOTES ON NEW GEOGRAPHIC DISTRIBUTIONS

MARNI G. ROLSTON¹, GREGORY D. JOHNSON^{1,3}, and D. GRANT HOKIT²

¹Department of Animal and Range Sciences, Montana State University, Bozeman, MT 59717

²Department of Natural Sciences, Carroll College, Helena, MT 59625

Abstract

An updated checklist of 50 species of mosquitoes found in Montana is presented and includes 2 new records (*Aedes niphadopsis* and *Anopheles walkeri*) that can be added to the 2005 state list by Darsie and Ward. The results of a statewide mosquito surveillance program, conducted annually from 2004 to 2015, facilitated the establishment of an abundance rating of the species in the state and expanded the known geographic range for *Coquillettidia perturbans*, *Ae. nigromaculis*, and *Culiseta minnesotae*.

Keywords

Checklist; distribution; Montana; mosquitoes; new record

The first published account of the Montana mosquito fauna contained 18 species in 4 genera (Parker 1916). Dyar (1917) reported 8 new *Aedes* species he collected while traveling the Northern Pacific Railroad through the state. Collections made by Dyar (1922) in Glacier National Park in northwest Montana yielded 9 new records, and he completed the first annotated list recognizing 35 mosquito species in the state (Dyar 1929). Subsequent taxonomic contributions by Mail (1934), Nielsen et al. (1963), and Quickenden and Jamison (1979, 1991) resulted in a state total of 46 species representing 6 genera (Darsie and Ward 2005). Nielsen (2009, 2012) reported *Aedes euedes* (Howard, Dyar and Knab) and *Aedes nevadensis* Chapman and Barr as new state records from collections he made in Glacier National Park in northwest Montana, bringing the state species total to 48.

With the arrival of West Nile virus (WNV) in Montana, a statewide mosquito surveillance program was initiated in 2004 with trap sites located in more than half of the state's 56 counties. With additional extramural funding, the surveillance program was expanded beginning in 2008 to include most of the counties in the state. Mosquitoes were collected using the Centers for Disease Control and Prevention miniature light traps (J. W. Hock, Gainesville, FL, USA) baited with CO₂ either from a compressed gas tank or dry ice. Collections were counted, mosquitoes identified to species, and putative vectors [*Culex*

³To whom correspondence should be addressed.

tarsalis Coquillett, *Cx. pipiens* Linnaeus, *Aedes melanimon* Dyar and *Aedes dorsalis* (Meigen)] were pooled for arbovirus testing (WNV, St. Louis encephalitis, and western equine encephalitis). Specimens were identified using taxonomic keys by Wood et al. (1979), Darsie and Ward (2005), and Thielman and Hunter (2007). The annual mosquito surveillance data were centralized into a web-based database (MSU-ES), which is searchable by year, county, or species and can be accessed at <http://django.msu.montana.edu/MTmosquito/>.

From these annual collections we identified 2 new state records, *Aedes niphadopsis* Dyar and Knab and *Anopheles walkeri* Theobald. This brings the total to 50 species representing 6 genera now reported from Montana (Table 1). Voucher specimens of these 2 species were deposited in the Montana Entomology Collection at Montana State University (MSU), Bozeman, Montana. An additional 40 species have been deposited within the Collection. The 2 new state records were as follows.

Aedes niphadopsis was collected in Golden Valley County, 46°24'55.26"N, 108°54'12.4524"W, 2F, June 6, 2013 (H. Goosey). According to Chapman (1963) this is an early spring species with a single generation. Its prevalence in Montana may be underrepresented since our surveillance activities usually started mid- to late June.

Anopheles walkeri was collected in Sheridan County, 48°23'26.322"N 104°34'41.6856"W, July 6, 2006, 1F, August 24, 2006, 12F, November 9, 2006, 1F (K. Hale); 48°28'57.1"N 104°27'1.42"W, August 6, 2013, 2F, August 5, 2015, 56F (G. Hokit); Big Horn County, 45°36'11.48"N 107°27'11.07"W, August 13, 2007, 1F (C. Taft); and Wibaux County, 46°59'11.0"N 104°11'11.67"W, August 13, 2013, 1F (D. Bertelsen). Multiyear collections suggest this species may be established in Sheridan County, although we consider it a rare species due to the low numbers collected.

Mosquito surveillance activities have resulted in the expansion of the known distribution of several mosquito species (Darsie and Ward 2005). *Coquillettidia* (= *Mansonia*) *perturbans* (Walker) was reported from Flathead County in northwest Montana as a new state record (Dyar 1922). In subsequent mosquito surveys, Mail (1934), Nielsen et al. (1963), Quickenden and Jamison (1991), and Nielsen (2009, 2012) did not report collecting this species. We identified *Cq. perturbans* in light trap collections from 22 counties east of the Continental Divide and 8 counties west of the Divide, substantially expanding the known distribution of this species in the state. Multiyear collections of this species were made from more than half of the 30 counties in the state. It was most abundant at 2 national wildlife refuges: Bowdoin (avg. 80 mosquitoes/light trap night [LTN]/year) and Ninepipe (avg. 75 mosquitoes/LTN/year) located in north-central and western Montana, respectively, where extensive tracts of cattails (*Typha*) and rushes (*Juncus*) occur.

Aedes nigromaculis (Ludlow) is an abundant species associated with riparian zones and irrigated agriculture in the grassland prairies of eastern Montana (Dyar 1922, Quickenden and Jamieson 1991). We collected this species from 4 counties west of the Continental Divide (Lincoln, Flathead, Lake, and Powell). Although collection numbers were low, multiyear collections were made from Lake County in northwest Montana.

Nielsen et al. (1963) reported *Culiseta minnesotae* Barr as a new state record collected from Flathead County in northwest Montana. Quickenden and Jamison (1991) and Nielsen (2009, 2012) did not report additional collections of this species. From 2004 to 2015, this species was collected from 13 counties, including Flathead, over multiple years. Although collection numbers were generally low, its distribution now extends into the mixed grass prairie in north-central, northeast, and south-central Montana.

The addition of 2 new state records (*Ae. niphadopsis* and *An. walkeri*) and the expanded geographic distribution of *Cs. minnesotae* and *Ae. nigromaculis* will likely have limited medical/veterinary importance because of the low numbers collected. This may change if populations increase dramatically. However, *Cq. perturbans*, generally regarded as mammalophilic, has been reported to feed on wading birds and passerines (Edmans 1971) and may serve as a potential vector of WNV (Cupp et al. 2007) or Cache Valley virus (Blackmore et al. 1998), both of which are present in Montana (Hokit et al. 2013, Johnson et al. 2014).

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Table 1

Checklist of mosquitoes found in Montana, abundance rating, and number of counties each species was collected from.

	Species	Abundance rating ¹	No. counties
1	<i>Aedes campestris</i>	Common	26
2	<i>Ae. canadensis canadensis</i>	Common	16
3	<i>Ae. cataphylla</i>	Uncommon	9
4	<i>Ae. cinereus</i>	Abundant	36
5	<i>Ae. communis</i>	Rare	5
6	<i>Ae. dianiaetus</i>	NA ²	1
7	<i>Ae. dorsalis</i>	Very abundant	48
8	<i>Ae. euedes</i>	NA ²	1
9	<i>Ae. excrucians</i>	Common	25
10	<i>Ae. fitchii</i>	Common	39
11	<i>Ae. flavescens</i>	Common	31
12	<i>Ae. hendersoni</i>	Rare	16
13	<i>Ae. hexodontus</i>	NA ²	3
14	<i>Ae. impiger</i>	NA ²	2
15	<i>Ae. implicatus</i>	Uncommon	17
16	<i>Ae. increpitus</i>	Abundant	39
17	<i>Ae. intrudens</i>	Rare	7
18	<i>Ae. melanimon</i>	Abundant	44
19	<i>Ae. mercurator</i>	NA ²	2
20	<i>Ae. nevadensis</i>	NA ²	1
21	<i>Ae. nigromaculis</i>	Abundant	30
22	<i>Ae. niphadopsis</i>	Very rare	1
23	<i>Ae. pionips</i>	NA ²	4
24	<i>Ae. provocans</i>	Very rare	3
25	<i>Ae. pullatus</i>	Very rare	2
26	<i>Ae. punctator</i>	Uncommon	11
27	<i>Ae. riparius</i>	NA ²	1
28	<i>Ae. schizopinax</i>	Rare	3
29	<i>Ae. sierrensis</i>	Rare	4
30	<i>Ae. spencerii idahoensis</i>	Abundant	35
31	<i>Ae. spencerii spencerii</i>	Common	33
32	<i>Ae. sticticus</i>	Abundant	37
33	<i>Ae. trivittatus</i>	Abundant	35
34	<i>Ae. vexans</i>	Very abundant	51
35	<i>Anopheles earlei</i>	Common	34
36	<i>An. freeborni</i>	Common	26
37	<i>An. punctipennis</i>	Uncommon	10

	Species	Abundance rating ¹	No. counties
38	<i>An. walkeri</i>	Rare	3
39	<i>Coquillettidia perturbans</i>	Abundant	30
40	<i>Culex pipiens</i>	Abundant	27
41	<i>Cx. restuans</i>	Rare	5
42	<i>Cx. tarsalis</i>	Abundant	51
43	<i>Cx. territans</i>	Very rare	1
44	<i>Culiseta alaskaensis</i>	NA ²	5
45	<i>Cs. impatiens</i>	Rare	10
46	<i>Cs. incidens</i>	Uncommon	12
47	<i>Cs. inornata</i>	Common	39
48	<i>Cs. minnesotae</i>	Common	13
49	<i>Cs. morsitans</i>	Uncommon	20
50	<i>Psorophora signipennis</i>	Common	11

¹ Abundance rating = total specimens collected from 2004 to 2015: Very abundant >100,000; Abundant, 10,000–999,999; Common, 1,000–9,999; Uncommon, 100–999; Rare, 10–99; Very rare, 1–9. Modified from Dunphy et al. (2014).

² Previously reported records by other authors; species abundance was not available.