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# MONTANA MOSQUITOES

Part I: Identification and Biology

A revision

by

Kenneth L. Quickenden, Ph.D.

STATE DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES  
Environmental Sciences Division  
Helena, Montana

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## ACKNOWLEDGEMENT

This bulletin is essentially a revised form of Mosquitoes of Montana by G. Allen Mail (1934). It has been somewhat updated and revised principally by referring to Mosquitoes of North America by Carpenter and LaCasse (1955). This bulletin liberally includes appropriate information from: Mosquitoes of Public Health Importance and Their Control by Pratt and Littig (1971), Identification Keys for Common Mosquitoes of United States by Pratt and Barnes (1959) and Mosquitoes of Colorado by Harmston and Lawson (1967).

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## INTRODUCTION

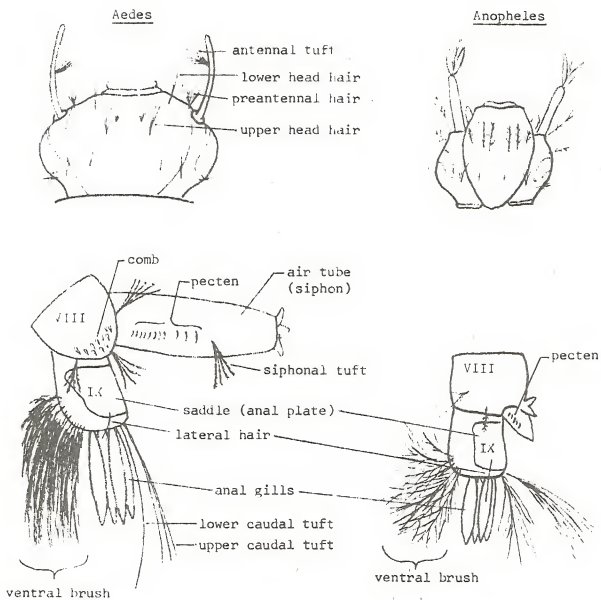
Mosquito abatement and other public health personnel in Montana may be called upon to combat the deleterious effects of particular mosquitoes. Knowledge about the breeding habitats and habits of the species involved will assist them in the conduct of their duties. It is intended that this bulletin will assist these personnel in determining what species are located in their area and what their effects might be.

There have been 43 species of mosquitoes reported in Montana distributed among six genera as: Aedes, 30 species; Anopheles, 3 species; Culex, 4 species; Culiseta, 4 species; Mansonia, 1 species and Psorophora, 1 species. The different species do not assume equal importance due to a variety of factors including difference in abundance, distribution and feeding habits. Some species can act as vectors (spread a disease); some are highly annoying to man and livestock and are of economic importance in Montana. Reliable quantitative data on the latter point is difficult to obtain. In estimating the economic impact, Mail (1934) stated that milk production could be reduced by 30 to 40 percent. Estimates of reduced weight gain in cattle vary but, as Hess and Quinby (1956) reported in "Mosquito News", losses of from 75 to 150 pounds per calf annually have been reported. Other economic losses such as those due to costs of medicines and repellants, reduced tourism and otherwise restricted outdoor activities of man have not been estimated.

Mosquitoes pass through a series of developmental stages from eggs to larvae to pupae to adults. The first three stages of development require water. Within this developmental pattern, there are four larval stages interspersed by molts in which the larvae "shed their skin". The time required for development and the number of generations produced each year depend on species differences, water temperatures, the availability of food and, in some cases, the number of times the eggs are flooded or irrigated.

Each species possesses a particular set of physical characteristics as noted on the included diagrams (pages 2, 7 and 8). Species may be classified by using the keys for classification of fourth stage larvae (pages 3 to 6) or adult females (pages 9 to 13). Complete species descriptions and classification of adult males according to their terminal abdominal segments have not been included in this bulletin but may be obtained by consulting such texts as Mosquitoes of North America by Carpenter and LaCasse. The non-biting adult males have antennae which are very bushy and palpi which are nearly as long as the proboscis. They are thus easily distinguished from the adult female with her short palpi (except for Anopheles sp.) and more sparsely haired antennae. Sample surveys conducted in several areas of Montana are included (pages 16, 17, and 18). Some were brief surveys; others are more complete.

LARVAL CHARACTERS USED IN IDENTIFICATION  
(Head and terminal, 8th and 9th, abdominal segments)



pecten teeth      comb scale





KEY TO MOSQUITO LARVAE OF MONTANA\*

Key to Montana Genera of Fourth Stage Larvae

1. Air tube present ..... 2  
Air tube absent ..... Anopheles
2. Pecten absent; air tube short, conical, sharply pointed ..... Mansonia  
Pecten present; air tube not sharply pointed ..... 3
3. Air tube with a pair of tufts near base ..... Culiseta  
Air tube without a pair of tufts near base ..... 4
4. Air tube with several pairs of tufts or single hairs ..... Culex  
Air tube with not more than one pair of tufts ..... 5
5. Anal segment ringed by sclerotized plate and pierced by  
tufts of the ventral brush ..... Prorophora  
Anal segment not completely ringed by sclerotized plate,  
or if ringed, the ventral brush does not pierce the plate ..... Aedes

Key to Montana Species of Fourth Stage Anopheles Larvae

1. Inner clypeal hairs bare ..... 2  
At least one inner clypeal hair with two or  
more branches near middle ..... A. earlei
2. No reliable characters are known for separating fourth stage  
larvae of A. freeborni and A. punctipennis

Key to Montana Species of Fourth Stage Aedes Larvae

1. Anal segment ringed by anal plate ..... 2  
Anal segment not completely ringed by plate (saddle) ..... 4
2. (1) Pecten teeth nearly uniformly spaced ..... 3  
Last 2 to 4 pecten teeth more widely spaced ..... A. nigromaculis
3. (2) Upper head hairs 1; lower head hairs 1; 22 comb  
scales in triangular patch ..... A. trivittatus  
Upper head hairs 2; lower head hairs 2; 8-17  
comb scales in two irregular rows ..... A. punctor  
Upper and lower head hairs single or double, 5-9  
thornshaped comb scales in an irregular row ..... A. hexodontus

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\*Modified from Mail (1934) Mosquitoes of Montana, Bulletin 288, Montana State College Agriculture Experiment Station; S. J. Carpenter and W. J. LaCasse (1955) Mosquitoes of North America, University of California Press, 360 pp. 127 plates; and H. D. Pratt and R. C. Barnes (1959) CDC Training Guide "Identification Keys for Common Mosquitoes of United States" 40 pp.

4.	(1)	Last 1 or 2 pecten teeth more widely spaced .....	5
		Pecten teeth nearly uniformly spaced .....	14
5.	(4)	Tuft on air tube outside the pecten .....	6
		Tuft on air tube within the pecten .....	13
6.	(5)	Upper and lower head hairs single .....	7
		Upper and lower head hairs not single .....	8
7.	(6)	Nine comb scales in an irregular double row .....	<u>A. spencerii</u>
		Fourteen comb scales in an irregular double row .....	<u>A. idahoensis</u>
8.	(6)	Four upper head hairs, three lower head hairs .....	9
		Head hairs not as above .....	10
9.	(8)	Four haired tuft on air tube, hairs plumose; anal gills as long as eighth abdominal segment .....	<u>A. flavescens</u>
		Four haired tuft on air tube, hairs naked; anal gills longer than eighth abdominal segment .....	<u>A. intrudens</u>
10.	(8)	Three detached pecten teeth .....	11
		Two detached pecten teeth .....	12
		One detached pecten tooth; 2 or 3 upper head hairs, 1 or 2 lower head hairs .....	<u>A. campestris</u>
11.	(10)	Multiple tufted head hairs; 19-21 comb scales in irregular double row; air tube 4 x 1; anal gills 2x as long as eighth segment .....	<u>A. cinereus</u>
		Three upper and three lower head hairs; 8-10 comb scales in irregular double row; air tube 2½ x 1; anal gills shorter than eighth segment .....	<u>A. diantaeus</u>
		Two upper and two lower head hairs; 8-10 comb scales in irregular double row; air tube 3 x 1; anal gills very short and pointed .....	<u>A. riparius</u>
12.	(10)	Usually 3 upper and 2 lower head hairs; 10-12 comb scales in irregular double row; air tube 3 x 1 .....	<u>A. vexans</u>
		Two upper and two lower head hairs; many comb scales in triangular patch; air tube 4 x 1 .....	<u>A. excrucians</u>
13.	(5)	Several dorsal tufts on air tube .....	<u>A. trichurus</u>
		No dorsal tufts on air tube .....	<u>A. cataphylla</u>
14.	(4)	Head hairs single .....	15
		Head hairs multiple .....	17
15.	(14)	Generally more than 18 comb scales in a triangular patch; pecten comb of more than 15 spines .....	16
		Comb of eighth segment with 8 to 16 scales; anal gills 3-4x as long as saddle (plate) .....	<u>A. impiger</u>

16. (15) Sixteen to 24 comb scales; pecten of 16-18 teeth in broad triangular patch; upper pair of anal gills about  $\frac{1}{2}$  as long as anal saddle in some specimens ..... A. melanimon  
About 25 comb scales; pecten of 21 closely set spines followed by 5 haired tuft; gills longer than anal segment ..... A. dorsalis  
Fourty to fifty comb scales; pecten of 18 spines followed by 5 haired tuft; gills longer than anal segments ..... A. communis  
Comb scales 25-35; upper head hair may be double; preantennal hair multiple, pecten of 18-24 spines followed by 3 haired tuft (occasionally 2 or 4) ..... A. implicatus
17. (15) Three or fewer head hairs in any tuft ..... 18  
More than 3 head hairs in a tuft ..... 22
18. (17) Lower head hairs 2-3 branched; 8-12 long, gradually tapered evenly fringed comb scales with short lateral spinules in an irregular double row, pecten comb followed by tuft of 1 or 2 hairs ..... A. triseriatus  
Comb scales many in a triangular patch; pecten comb followed by a tuft of more than two hairs ..... 19
19. (18) Three upper and 2 lower head hairs, gills short and leaf-like ..... A. schizopinax  
Gills longer or as long as anal segment ..... 20
20. (19) Pecten reaching middle of  $2\frac{1}{2} \times 1$  air tube ..... A. sticticus  
Pecten not reaching middle of air tube ..... 21
21. (20) Air tube about  $3 \times 1$ ; 2 or 3 upper head hairs, 1 or 2 lower head hairs; median spine of individual comb scale less than  $1\frac{1}{2} \times$  longer than subapical spinules ..... A. increpitus  
Air tube about  $3 \times 1$ ; usually 2, sometimes 3 upper head hairs, 1 or 2 lower head hairs; median spine of comb scales are  $1\frac{1}{2} \times$  as long as subapical spinules ..... A. stimulans
22. (17) Pecten of about 28 spines followed by 7 or 8 haired tuft; 70 or more comb scales ..... A. pionips  
Pecten of less than 28 spines followed by a 4 or 5 haired tuft; less than 60 comb scales in patch ..... 23
23. (22) Air tube slender,  $4-5 \times 1$ ; 3 or 4 upper head hairs, 2 or 3 lower head hairs ..... A. fitchii  
Air tube 3-4x as long as wide ..... 24
24. (23) Gills about as long as anal segment; hairs of pecten tuft naked ..... A. canadensis  
Gills longer than anal segment; hairs of pecten tuft plumose ..... A. pullatus

Key to Montana Species of Fourth Stage Culex Larvae

1. Lower head hairs single or double, individual  
 pecten teeth with one to four coarse side teeth ..... C. territans  
 Upper and lower head hairs multiple and long ..... 2
2. Antennae nearly uniform in shape, tuft near middle;  
 three pairs of long single hairs and one pair of  
 2-3 branched hairs on air tube ..... C. restuans  
 Antennae constricted beyond antennal tuft; 4-5  
 pairs of multiple hair tufts on air tube ..... 3
3. Tufts on air tube are in a straight line ..... C. tarsalis  
 One or two pairs of tufts on air tube are laterally  
 out of line; upper and lower head hairs of 5 or  
 more branches ..... C. pipiens

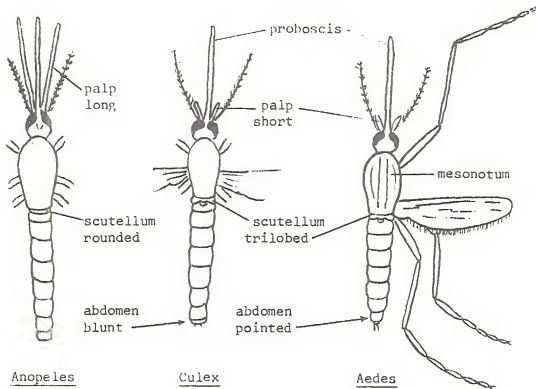
Key to Montana Species of Fourth Stage Culiseta Larvae

1. Upper and lower head hairs multiple, similar in  
 size and number of branches ..... C. impatiens  
 Lower head hairs in 3 or 4, upper head hairs  
 multiple and usually longer ..... 2
2. Lateral hair of anal segment strong, single to  
 triple, as long or longer than anal plate; basal  
 pecten with 3-4 outstanding teeth ..... C. inornata  
 Lateral hairs of anal segment fine,  
 shorter than anal plate ..... 3
3. Basal pecten teeth slender with 1 or 2 appressed  
 teeth; mesothorasic hair 1 small, usually single;  
 anal plate narrow, widely separated from barred  
 area of ventral brush ..... C. incidens  
 Mesothorasic hair 1 small, usually multiple; anal  
 plate broad, close to barred area of ventral brush ..... C. alaskaensis

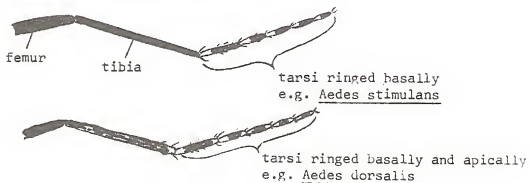
Key to Montana Species of Fourth Stage Mansonia and Psorophora Larvae

Records indicate that each genus is represented by only one species. Mansonia perturbans larvae have long conspicuous tufted antennae and has one margin of the air tube forming a saw. Psorophora signipennis larvae have an inflated air tube, small pecten with four spines at the base and a sclerotized plate completely encircling the anal segment.

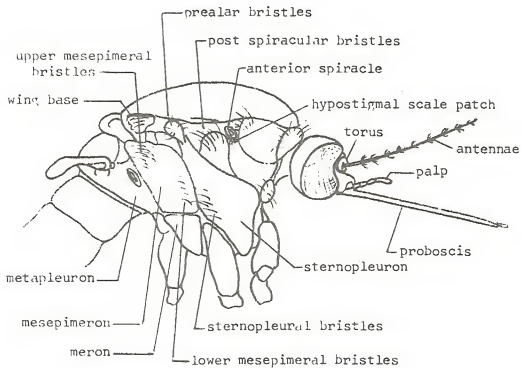
Characters Used in Classification of Adult Mosquitoes



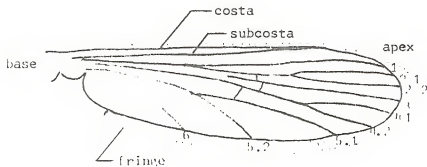
Mosquito Legs



Adult Characters Used in Classification



PSOROPHORA HEAD AND THORAX



MOSQUITO WING

KEY TO ADULT FEMALE MOSQUITOES OF MONTANA

Key to Montana Genera of Adult Female Mosquitoes

1. Palpi about as long as proboscis; scutellum rounded,  
not lobed ..... Anopheles  
Palpi much shorter than proboscis; scutellum trilobed ..... 2
2. Tip of abdomen pointed, segments 7 and 8 narrowed,  
8 retractile; postspiracular bristles present ..... 3  
Tip of abdomen blunt, not narrowed, segment 8  
short but not retractile; postspiracular bristles  
absent ..... 4
3. Spiracular bristles present; first hind tarsal segment  
with 2 widely separated black bands ..... Psorophora  
Spiracular bristles absent; first hind tarsal segment  
with one band or none ..... Aedes
4. Wing scales very broad, mixed dark and light colored;  
proboscis pale banded ..... Mansonia  
Wing scales hair-like; proboscis pale banded or not ..... 5
5. Spiracular bristles absent; base of subcostal vein  
without a tuft of hairs on underside of wing ..... Culex  
Spiracular bristles present; base of subcostal vein  
with a tuft of hairs on underside of wing ..... Culiseta

Key to Montana Species of Adult Female Anopheles

1. Scales on wings yellow and black in large patches ..... A. punctipennis  
Scales on wings dark, wings with 4 dark spots ..... 2
2. Fringe at apex of wing uniformly dark ..... A. freeborni  
Fringe at apex of wing with a patch of  
golden or coppery scales ..... A. earlei

Key to Montana Species of Adult Female Aedes

1. Hind tarsi ringed ..... 2  
Hind tarsi unringed ..... 12
2. (1) Some tarsal segments ringed basally and apically ..... 3  
Tarsal segments ringed only basally ..... 5
3. (2) Wing scales mixed dark brown and white,  
markedly bicolored ..... 4  
Wing scale entirely dark or nearly so;  
mesonotum reddish yellow ..... A. canadensis

4. (3) Upper surface of abdomen with white median longitudinal stripe or occasionally nearly all white scaled; white and dark wing scales not evenly mixed; more dark scales on vein 3 than 2 or 4 ..... A. dorsalis  
Upper abdominal stripe more diffuse; white and dark wing scales evenly intermixed, white scales predominating ..... A. campestris  
Abdominal stripe usually narrower than A. dorsalis; white and dark scales evenly intermixed, dark scales predominating ..... A. melanimon
5. (2) Proboscis white ringed, white abdominal stripe ..... A. nigromaculis  
Proboscis not white ringed ..... 6
6. (5) Tarsal bands narrow; pale abdominal bands indented on mid-dorsal line (B-shaped) ..... A. vexans  
Tarsal bands broad ..... 7
7. (6) Abdomen unbanded; large mosquito clothed with yellow scales ..... A. flavescens  
Abdomen banded ..... 8
8. (7) Mesonotum with broad, light reddish brown median stripe; lower mesepimeral bristles absent or rarely more than two; white scales on dorsal  $\frac{1}{2}$  of tori ..... A. fitchii  
Mesonotum not colored as above ..... 9
9. (8) Costal vein entirely dark scaled or with few scattered pale scales at the base of vein; tori without dorsal white scales ..... A. increpitus  
Costal vein dark but with some white scales beyond base ..... 10
10. (9) Main tooth of tarsal claws bent beyond base of lateral tooth ..... 11  
Main tooth of tarsal claws bent near base of lateral tooth, main and lateral teeth parallel; mesonotum reddish brown, flecked with white patches--sometimes forming white lines ..... A. excrucians
11. (10) Lower mesepimeral bristles usually 3 or more; lateral tooth of tarsal claw slender, about  $\frac{1}{2}$  as long as main tooth; mixed white and golden-yellow scales on mesonotum ..... A. stimulans  
Lower mesepimeral bristles absent; lateral tooth of claw less than  $\frac{1}{2}$  as long as main tooth ..... A. riparius
12. (1) Mesonotum with dark brown scales forming a median stripe, sides and median margin with silver-white scales ..... A. triseriatus  
Mesonotum with pair of broad yellowish-white to brassy yellow stripes separated by a brown stripe of about the same width ..... A. trivittatus  
Mesonotum otherwise marked ..... 13



13. (12) Mesonotum uniformly dark; white, lateral abdominal spots usually uniting to form a continuous line ..... A. cinereus  
Abdomen without continuous lateral white line ..... 14
14. (13) Wing scales bicolored, mixed dark and white ..... 15  
Wing scales uniformly dark ..... 16
15. (14) Upper abdominal surface with a median longitudinal stripe of white scales or nearly all pale scaled ..... A. spencerii  
Upper abdominal surface generally without median stripe, with segmented cross bands ..... A. idahoensis
16. (14) Mesonotum with median usually undivided dark stripe ..... 17  
Mesonotum with median divided dark stripe or none ..... 18
17. (16) Mesonotum with median well contrasted broad stripe of golden-brown scales, sometimes divided by a narrow median line of pale scales; grayish or yellowish-white sides; lower mesepimeral bristles absent ..... A. sticticus  
Mesonotum clothed with pale gray and having a median chocolate-brown stripe; lower mesepimeral bristles 3-6 (in part) ..... A. trichurus  
Mesonotum with poorly contrasted broad bronzy-brown to dark brown median stripe, sometimes with paler scales on mid-line; sides of the mesonotum golden to yellowish brown or reddish brown; lower mesepimeral bristles 1-5 ..... A. punctor  
Mesonotum clothed with yellowish scales and with a broad median dark stripe as in A. punctor; pleuron with extensive grayish-white patches; lower mesepimeral bristles 1-3 ..... A. hexodontus
18. (16) Mesonotum without contrasting stripes, lower mesepimeral bristles present ..... 19  
Mesonotum with contrasting stripe ..... 21
19. (18) Thorax with many long brownish-black or black setae (hairs), giving the species a hairy appearance ..... A. impiger  
Thorax with normal setae, not appearing exceptionally hairy ..... 20
20. (19) Mesepimeron bare on lower 1/4 - 1/3; mesonotum uniformly dark and bronzy, often with two faint narrow median brown stripes ..... A. intrudens  
Numerous scattered white scales on costa, subcosta and vein 1 of wing; scales on mesepimeron reach to lower margin ..... A. cataphylla

21. (18) Lower mesepimeral bristles present ..... 22  
Lower mesepimeral bristles absent; white  
abdominal basal bands narrow or absent;  
sternopleuron with 12-20 hairs ..... A. diantaeus
22. (21) Few to many white scales forming a  
hypostigmal spot on pleuron of mesothorax ..... 23  
Hypostigmal spot of scales absent ..... 25
23. (22) Mesonotum with paired base submedian stripes  
separated by a pair of narrow stripes of golden  
yellow to light brown separated by a very narrow  
bare median line ..... A. pullatus  
Mesonotum with broad median stripe or narrowly  
divided stripes of brown scales ..... 24
24. (23) Scales on sternopleuron extend half way to anterior  
angle, narrowly separate from scale patch on prealar  
area, white scales on wing restricted to a patch at  
base of costa ..... A. implicatus  
Scales on sternopleuron extend to anterior edge, not  
separate from patch on prealar area (in part) ..... A. trichurus
25. (22) Proboscis with yellowish gray scales on ventral  
surface ..... A. schizopinax  
Proboscis with brown scales on ventral surface ..... 26
26. (25) Pale abdominal bands broad and even; mesonotum  
yellow or gray, variable, sometimes with brown  
centrally or lines obsolete ..... A. communis  
Abdominal bands narrow and even; mesonotum yellow  
to gray, rather well defined broad dark-brown  
stripes passing around the antescutellar space,  
yellowish scaled line separating the submedian  
stripes narrower than A. communis ..... A. pionips

Key to Montana Species of Adult Female Culex

1. Proboscis and tarsi ringed with white ..... C. tarsalis  
Proboscis and tarsi entirely dark ..... 2
2. Abdominal segments with white scales at apex (most  
posterior edge) most evident at sides ..... C. territans  
Bases of abdominal segments with white or yellowish  
scales ..... 3
3. Mesonotum with pair of small white patches near  
middle; scales on mesonotum fine and coppery ..... C. restuans  
Mesonotum without white patches; scales on  
mesonotum coarse and brassy ..... C. pipiens

Key to Montana Species of Adult Female Culiseta

1. Hind tarsi ringed with white or yellowish white ..... 2  
Hind tarsi unringed ..... 3
2. Some tarsal segments with broad white rings, 2nd  
segment ring covering 1/4 to 1/3 of segment ..... C. alaskaensis  
Tarsal segments with very narrow white rings, 2nd  
segment ring covering about 1/10 of segment ..... C. incidens
3. Many pale scales along costal margin of wings;  
legs pale scaled ..... C. inornata  
Wing scales dark; legs dark scaled ..... C. impatiens

## COMPARATIVE DATA UPON MONTANA MOSQUITOES

(Modified from Mail (1934) Mosquitoes of Montana, Bulletin 288,  
Montana State College Agricultural Experiment Station)

Species	Comparative Abundance*	Important Lowland Species	Predominately Mountain Species	Number Generations per year
<u>Aedes campestris</u>	3			1
<u>canadensis</u>	2			1
<u>cataphylla</u>	5		x	1
<u>cinereus</u>	3		x	1
<u>communis</u>	3		x	1
<u>diantaeus</u>	6		x	1
<u>dorsalis</u>	1	x		1?
<u>excrucians</u>	4			1 to many
<u>fitchii</u>	2		x	1
<u>flavescens</u>	1		x	1
<u>hexodontus</u>	4		x	1
<u>idahoensis</u>	1	x		1
<u>impiger</u>	4		x	1
<u>implicatus</u>	4		x	1?
<u>increpitus</u>	1	x	x	1
<u>intrudens</u>	3		x	1
<u>melanimon</u>	4			?
<u>nigromaculis</u>	1	x		1 to many
<u>pienips</u>	5		x	1
<u>pullatus</u>	3		x	1
<u>punctor</u>	2		x	1
<u>riparius</u>	6			?
<u>schizopinax</u>	4			1
<u>spencerii</u>	1	x		1, may be 2 or 3
<u>sticticus</u>	3			1, may be few smaller broods
<u>stimulans</u>	6			1
<u>trichurus</u>	6		x	1?
<u>triseriatus</u>	6			several
<u>trivittatus</u>	3			several
<u>vexans</u>	1	x		1, all eggs do not hatch with each flood or some report: several

\*Comparative Abundance: 1, abundant; 2 common; 3, fairly common; 4, fairly rare; 5, rare; 6, very rare.

<u>Species</u>	<u>Comparative Abundance*</u>	<u>Important Lowland Species</u>	<u>Predominately Mountain Species</u>	<u>Number Generations per year</u>
<u>Anopheles earlei</u>	3?			several
<u>freeborni</u>	4			several
<u>punctipennis</u>	6			several
<u>Culex pipiens</u>	3	x		several
<u>restuans</u>	4			several
<u>tarsalis</u>	2	x		several
<u>territans</u>	5			1 or several
<u>Culiseta alaskaensis</u>	4		x	1
<u>impatiens</u>	4			1 or several
<u>incidens</u>	3	x		several
<u>inornata</u>	2	x		several
<u>Mansonia perturbans</u>	6			1
<u>Psorophora signipennis</u>	5			several

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\*Comparative abundance: 1, abundant; 2, common; 3, fairly common; 4, fairly rare; 5, rare; 6, very rare.

SUMMARY OF MOSQUITO SURVEYS IN SEVERAL AREAS OF MONTANA  
(not a complete listing of species found in each region)

1. Surveys in irrigated areas of the Milk River Valley near Chinook and Harlem (Blaine County)<sup>1</sup>

Type of Collection and/or Habitat	Percentage for Each Species Found											
	Aedes campestris	Aedes dorsalis	Aedes idahoensis	Aedes increpitus	Aedes nigromaculis	Aedes spencerii	Aedes trivittatus	Aedes vexans	Anopheles earlei	Culex tarsalis	Culex territans	Culiseta inornata
<b>LARVAL COLLECTIONS</b>												
<u>Off Field Water</u>												
Temporary Water (2715 identified)	1	33	7	<1	3	<1	1	40	<1	8	<1	6
Semi-permanent & Permanent Water (1052 identified)		20	8		2		<1	24	4	12	<1	29
<u>On Field Water</u>												
Crop: alfalfa (1977 identified)	<1	40	5	<1	9	<1	1	36		6		2
Pasture (1469 identified)		25	5		13	<1	1	51		3	<1	1
Bluejoint Meadow (385 identified)		25	14		1	1		58				
<b>ADULT COLLECTIONS</b>												
Light Trap		9			18			21		30		18
Biting		11	8		39			39				

The temporary water sources included roadside ditches, borrow pits wasteland areas, abandoned canals and laterals. Semi-permanent and permanent water sources included roadside ditches, borrow pits, drainage ditches, oxbows and sloughs and the distribution system. Other species reported in this region include Aedes cinereus, Aedes flavescens and Aedes melanimon.

<sup>1</sup>Mosquito Investigations, Milk River Irrigation Project, Montana, with Particular Reference to the Causes of Mosquito Production in a Long-Established Irrigated Area Characterized by Flat Topography and Heavy Soils" (1953) Communicable Disease Center, PHS, U.S. Dept. of Health, Education, and Welfare, 53 pp.

2. Hardin (Big Horn County)<sup>2</sup>

A larval survey of roadside ditches and a pasture drain revealed the following species in June, 1966:

Species	Numbers collected at station type		
	Roadside ditch with grass and cattail	Pasture drain	Roadside ditch
<u>Aedes campestris</u>			2
<u>Aedes dorsalis</u>	10	23	4
<u>Aedes increpitus</u>			2
<u>Aedes spencerii</u>		1	1
<u>Aedes vexans</u>		13	
<u>Culex tarsalis</u>	1	1	1

3. Miles City (Custer County)<sup>3</sup>

Species	Numbers of larvae collected		Adult biting collection
	Roadside pool	Shallow water in grassy areas	
<u>Aedes dorsalis</u>			1
<u>Aedes nigromaculis</u>		11	7
<u>Aedes trivittatus</u>			2
<u>Aedes vexans</u>	5	4	5
<u>Psorophora signipennis</u>		1	

<sup>2</sup> Observations on the Mosquito Problem at Hardin, Montana, June 8, 1966 by L. D. Beadle, Entomologist, CDC, Department of Health, Education, & Welfare.

<sup>3</sup> Observations on the Mosquito Problem at Miles City, Montana, June 9, 1966 by L. D. Beadle, Entomologist, CDC, Department of Health, Education, and Welfare.

4. Survey along the Musselshell River under flood conditions on June 29, 1967 (Musselshell and Golden Valley Counties)<sup>4</sup>

Species Located:	Area of Collection			
	Lavina	Melstone	Roundup	Ryegate
Adults:				
<u>Aedes cinereus</u>	x			
<u>Aedes dorsalis</u>				x
<u>Aedes idahoensis</u>	x		x	
<u>Aedes increpitus</u>			x	
<u>Aedes melanion</u>			x	
<u>Aedes nigromaculis</u>	x			
<u>Aedes vexans</u>	x	x	x	x
Larvae:				
<u>Culex tarsalis</u>		x		
<u>Culiseta inornata</u>			x	

Aedes vexans represented 97% of the adult mosquitoes taken in the Roundup area during this survey. In the Lavina area it appeared that Aedes nigromaculis outnumbered the Aedes vexans.

5. Surveys in the Great Falls area in August 1944, April 1957, and July 1968. (Cascade County)<sup>5</sup>

Although many species exist in Cascade County, the most important species in the Great Falls area are reported to be Aedes dorsalis, Aedes idahoensis, Aedes increpitus, Aedes nigromaculis, Aedes sticticus, Aedes vexans, Anopheles earlei, and Culex tarsalis. Other confirmed species in the county include Aedes cinereus, Aedes communis, Aedes hexodontus, Aedes melanion, Culex pipiens, and Culiseta inornata. Mr. Toenyes has tentatively identified two species not reported in this bulletin. He took a single specimen of a large reddish-brown Culex species which he labeled as Culex erythrothorax Dyar and a number of Aedes which may be Aedes hendersoni Cockerell.

<sup>4</sup>Report on the Mosquito Problem associated with the Flooding of the Musselshell River, Montana, June 29, 1967 by L. J. Ogden and E. J. Heidig, Biologist, PHS, Department of Health, Education, and Welfare.

<sup>5</sup>Cascade County Mosquito Abatement District Manual, 1969, by J. B. Toenyes and G. L. Gingery.



Notes on Mosquito Species Reported in Montana

AEDES CAMPESTRIS Dyar and Knab

DISTRIBUTION: This mosquito is commonly found in association with Aedes dorsalis. It looks similar but is larger, more drab, and less common. Aedes campestris is fairly widely distributed in the more arid, prairie regions, never having been collected in the mountains or wooded sections of the state.

BIONOMICS: Little is known about the life history. This mosquito overwinters in the egg stage and is very resistant to adverse conditions. Larvae appear to prefer alkaline pools which are rich in organic content. They may be found in rain, snow, or irrigation waste water.

IMPORTANCE: This mosquito is not sufficiently numerous to constitute a pest by itself. However, it is occasionally an important constituent of the pest mosquito population in irrigated areas. Females are found resting in the grass by day but will bite readily if disturbed either day or night.

AEDES CANADENSIS Theobald

DISTRIBUTION: Aedes canadensis is a forest species found throughout the western portion of the state on both slopes of the Rockies. It is not found in open prairie regions.

BIONOMICS: This mosquito overwinters in the egg stage. Preferred larval habitats are temporary woodland pools containing fallen leaves. Larvae may also be found in roadside ditches, ground puddles, isolated oxbows of woodland streams, and backwater areas of rivers floored with dead leaves and grass. In deeper pools the larvae favor the shallow margins. Neutral waters appear to afford the best larval conditions although a broad pH range is tolerated. Larvae may appear in snow water pools in early spring and all summer in freshly formed rain pools. Mail (8) believes that the later larvae result from eggs whose hatching has been delayed and that there is one generation per year in Montana. Adult collections of the Aedes canadensis have been made from May to the first week in August.

IMPORTANCE: This mosquito is not a severe pest except in restricted localities since it is confined to wooded regions of the state and it tends to stay close to the breeding sites. Aedes canadensis is a persistent, severe biter and may greatly annoy residents and sportsmen in wooded regions.

AEDES CATAPHYLLA Dyar

DISTRIBUTION: This mosquito ranges along the Rocky Mountains and has been collected in Gallatin County, the Bitterroot Valley, and Glacier Park.

BIONOMICS: This species overwinters in the egg stage. Suitable larval habitat may be woodland pools, grassy pools on river banks, and roadside pools which are floored with mud and leaves. Aedes cataphylla merges early in the spring and adults attack readily. Although there is only one generation per year, the adults emerge at different times at different elevations.

IMPORTANCE: This mosquito is too rare to be of any major importance in this state.

AEDES CINEREUS Meigen

DISTRIBUTION: This species appears to be exclusively a mountain species. It is known to occur in the Gallatin Valley and in the Bitterroot Valley.

BIONOMICS: This species overwinters in the egg stage. Adults first emerge from shallow pools at the edge of melting snow in the woods. Later, adults emerge from rain pools. Larval habitat is always located near timber. It may be woodland pools, seepage from rivers, or occasionally roadside ditches. The water may be neutral to slightly alkaline. The flight range of emerging adults is limited. They remain in the woods close to their breeding habitats and rarely come into the open. This species is commonly associated with Aedes increpitus and Aedes spencerii. Adults of Aedes cinereus may be found between the end of May and the end of July. There is one generation per year.

IMPORTANCE: Aedes cinereus is of little importance in Montana. Although it may be a severe biter, it will not always attack, tends to be quite localized, will not enter houses, and does not move far from its breeding places.

AEDES COMMUNIS (DeGeer)

DISTRIBUTION: This species has been reported only from forest sections of Montana on both sides of the Continental Divide.

BIONOMICS: Aedes communis overwinters in the egg stage. Larvae are found in the first formed snow pools in ground depressions in mountain meadows and forests, and roadside ditches in the mountains. The floor of these pools is usually covered with leaves, moss and sparse grass. There is only one generation per year. Larvae have been found during early April and as late as July 3 at an altitude of 8,000 feet. Larvae generally are found in neutral waters but have a pH tolerance of from 6.5 to 7.9. The latest adult collection was made on July 21 in a mountain area although a few may persist throughout the summer. Adults remain in wooded areas during daylight hours but may come into the open to attack in the evening.

IMPORTANCE: This is one of the most common mosquitoes at elevations above 5,000 feet. Where it occurs it may be numerous and a bad biter, especially at dusk.

AEDES DIANTAEUS Howard, Dyar and Knab

DISTRIBUTION: This species has only been reported from Glacier Park.

BIONOMICS: This mosquito overwinters in the egg stage. Larvae are found mostly in shaded early spring pools at high altitudes and only in dense forests. Dyar (2) has reported finding this species in flood pools in a mountain valley in mid-summer.

IMPORTANCE: This species is too rare to be of any importance in Montana.

AEDES DORSALIS (Meigen)

DISTRIBUTION: This species is widely distributed both on the prairies and in the mountains.

BIONOMICS: Eggs are laid singly either on shallow water or in damp depressions. They may remain viable for several years if not flooded. This species overwinters in the egg stage. Suitable larval habitat appears to be quite diverse. It thrives best in waters of high alkalinity but has a pH tolerance range from about 7.1 to 9.6. While its preferred habitat appears to be grassy pools exposed to direct sunlight in prairie regions, this is the dominant form in Milk River Valley irrigation districts. Larvae commonly develop in irrigation and flood waters. They have been found in open temporary grassy pools, semi-permanent pools with cattails and other aquatic vegetation as well as in shaded woodland pools. Frequently they are associated with Aedes vexans. At room temperature eggs have been known to hatch in 5 days. Larvae mature in hot weather in nature in about 8 days from the time of hatching. It is possible to have a new generation every 17 days. Adults are found from early April until late November. Aedes dorsalis is a strong flier and has an effective flight range of 10 to 20 miles or more. Adult females are especially active during evenings and on calm cloudy days. They are, however, vicious biters and will attack day or night.

IMPORTANCE: Aedes dorsalis is the most important mosquito pest species in Montana. Because of its brief developmental period and the fact that there can be a new generation each time water fills depressions containing eggs, this mosquito is a most important economic factor in agriculture. Its life cycle is well adapted to the flood system of irrigation as practiced in many parts of the state. Aedes dorsalis avidly attacks man and livestock and is a severe pest.

AEDES EXCRUCIANS (Walker)

DISTRIBUTION: This species has been reported only from heavily timbered areas on both sides of the Continental Divide.

BIONOMICS: There is one generation per year. Larvae are found in open swamps surrounded by woods, grassy marshes, open pools in the forests with a gravel bottom floored by dead leaves, and in flooded backwater areas. The water is usually neutral or slightly alkaline. It is often associated with Aedes cinereus and Aedes fitchii. Adults are generally found late in the season. At lower altitudes however, they will emerge earlier. Females will bite at any time if disturbed but are more active in the evening. This mosquito overwinters in the egg stage.

IMPORTANCE: This mosquito is usually not sufficiently numerous to be of major importance in the state.

AEDES FITCHII (Felt and Young)

DISTRIBUTION: This species is most frequently found in timbered mountainous regions and is common throughout western Montana. It has also been found in northern plains areas.

BIONOMICS: Eggs are laid at the edge of receding grassy pools or in crevices in beds of previous pools. This species overwinters in the egg stage. Larvae will often be found at the edges of melting snow or deeper woodland pools early in the spring. Larvae have been found near Glasgow early in April associated with Aedes increpitus. Aedes fitchii is rarely found in exposed temporary water. Larvae appear to thrive best in neutral water, having a pH of about 7.1 but can tolerate alkaline water at 8.3. Adults are found from April to the first week in August. There is one generation per year.

IMPORTANCE: Aedes fitchii is not of great economic importance in this state. It can at times be a pest to fishermen and workers in timbered regions. Cattle on summer ranges in the mountains may be plagued by this mosquito

#### AEDES FLAVESCENS (Muller)

DISTRIBUTION: This species is distributed throughout the northern prairie area and may be found in a few open situations in the eastern foothills of the Rocky Mountains. It has not been found in wooded mountainous nor in the southeastern part of the state. Its occurrence west of the Continental Divide is questionable.

BIONOMICS: Overwintering eggs hatch in early snow pools in the spring. Deeper pools and marshes appear to be favored. Larval development is relatively slow. Larvae have occasionally been found in ditches around irrigated fields at Malta where the adults are, on occasion, numerous. Larvae thrive in alkaline environments and have been found in water with a pH of between 8.0 and 8.3. Adults may be found from the end of April until the end of July. There is one generation per year.

IMPORTANCE: Aedes flavescens is not an important mosquito in Montana since it is rarely sufficiently numerous enough to constitute a pest. It attacks cattle more readily than man.

#### AEDES HEXODONTUS Dyar

DISTRIBUTION: Aedes hexodontus is a mountain species.

BIONOMICS: Little is known of the life history in Montana. This species overwinters in the egg stage. Some eggs hatch as soon as snow begins to melt, while in other cases, hatching is delayed. Larvae may be found in pools in open marshy meadows. Although adult females bite principally at dusk or in shaded situations, they will attack in full sunlight.

IMPORTANCE: This species may be an important pest in a few mountain areas but is generally too uncommon.

#### AEDES IDAHOENSIS (Theobald)

DISTRIBUTION: Aedes idahoensis is third in abundance in Montana. It is widely distributed both on the prairies and in the mountains. It is usually associated with Aedes vexans and quite often with Aedes dorsalis and Aedes increpitus.

**BIONOMICS:** Winter is passed in the egg stage. There is one generation per year. Like Aedes dorsalis it prefers alkaline habitats. Eggs may be laid 2½ days after feeding. Mail (8) states that the average number of eggs laid by individuals in the laboratory was 53.1. These eggs were not observed to hatch unless subjected to temperatures below 0° centigrade. At constant temperatures, the average length of larval life was 13 days at 22° centigrade, 10 days at 27° centigrade, and 5 days at 32° centigrade. Larvae may be found in snow or rain pools, open meadows, roadside ditches, etc. Adults may fly several miles from their larval habitats. While it is most active at dusk, it may also be a vicious biter in shaded or cloudy situations by day.

**IMPORTANCE:** Aedes idahoensis is one of the most important species in Montana due to its wide distribution and large numbers in mosquito control areas. It may be a great source of annoyance to both man and livestock.

AEDES IMPIGER (Walker)

**DISTRIBUTION:** This species has only been reported from Glacier Park. Adults were collected there at Swift Current Pass at an elevation of 7,500 feet at the end of July by Mail (8).

**BIONOMICS:** Larvae are found in clear pools formed by melting snow at high elevations in mountains where alpine, arctic conditions exist. The rate of larval development is very slow. This species overwinters in the egg stage. Females are reported to feed readily at all hours even in full sunlight.

**IMPORTANCE:** This species is too uncommon and occurs at too high altitude to be of economic importance in Montana.

AEDES IMPLICATUS Vockeroth

**DISTRIBUTION:** This species is predominantly a forest species.

**BIONOMICS:** Larvae are found in temporary pools and are among the first to appear in the spring. Mail (8) reported finding larvae in snow water pools in woods and meadows wooded sections. He reports that larvae have been collected as early as April 4 and as late as July 21. Females bite avidly in the shade by day or in the evening. There is only one generation per year.

**IMPORTANCE:** This mosquito is not numerous enough to be of much importance in the state.

AEDES INCREPITUS Dyar

**DISTRIBUTION:** Aedes increpitus has been found in both mountainous and the prairie regions of the state, however, it is more numerous in the forested mountainous region. Its distribution parallels that of Aedes fitchii.

**BIONOMICS:** Aedes inerepitus is frequently found in roadside ditches filled with irrigation water or heavy spring rains. It is often found in temporary pools along river banks which are left after high water. Earliest larvae have been obtained from roadside pools early in April. The pH range of water in which larvae have been taken ranges from 7 to 8. Adults may be found from the last week in April until the first week in August. Eggs are laid on damp ground at the edge of pools. More than one generation per year has not been demonstrated.

**IMPORTANCE:** This mosquito is one of the dominant species in Montana and may invade urban areas, but is of greatest importance in wooded areas. Mail (8) states it is a severe biter and a source of great annoyance to cattle on summer range in the mountains as well as to tourists, sportsmen, and those working in timbered regions during the mosquito season.

#### AEDES INTRUDENS Dyar

**DISTRIBUTION:** Aedes intrudens is found in the foothills of both slopes of the Continental Divide. It is typically a forest mosquito that does not occur in prairie regions. It is fairly common in timbered country.

**BIONOMICS:** Aedes intrudens overwinters in the egg stage. Larvae hatch in snow water which is usually neutral or slightly acidic. However, they have been taken from highly alkaline pools. The larval habitat which may include woodland pools, marshes, and water filled ditching is typically floored with dead leaves or moss. There is one generation per year. Adults may be found early in the spring at lower elevations and may be taken late in August at higher elevations.

**IMPORTANCE:** State wide, this mosquito is not important. However, in certain local areas it may be a vicious pest, both by day and night.

#### AEDES MALANIMON Dyar

**DISTRIBUTION:** This species has been collected at Chinook and Roundup but is probably widely distributed in the state. Cascade County also has this species.

**BIONOMICS:** Very little is known of the life history of this species in Montana. This species overwinters in the egg stage. Eggs hatch in melting snow and woodland pools. Larvae may be found along the edge of small clear mountain streams, in temporary rain pools, but are most commonly found in overflow pools along streams. They occasionally occur in irrigation seepage in the shaded or partly shaded situations. Females will bite during daylight hours in shaded situations but are more active at dusk. Adults may be found between late April and August.

**IMPORTANCE:** This mosquito is not known to be important in Montana but may be at times an economic pest of livestock. Studies in Colorado (5) indicated that 92% of this species collected were engorged with cattle blood.

#### AEDES NIGROMACULIS (Ludlow)

**DISTRIBUTION:** This species is found in more arid prairie regions of Montana. It is one of the chief components of the mosquito fauna located in irrigated areas. This species has never been reported from mountainous or timbered regions.

**BIONOMICS:** This species overwinters in the egg stage but eggs do not appear to require a cold stimulus for hatching. Aedes nigromaculis is able to produce a new brood with each flooding or irrigation, resulting in many generations and large populations each year. Larvae appear to prefer alkaline conditions and are frequently found in open sunlit pools of waste irrigation and other temporary water. Larvae have been found in the middle of May. Adults have typically been collected through the end of August although one collection was recorded at Cascade in mid-November, 1929. They have an effective flight range of 2 to 5 miles.

**IMPORTANCE:** Aedes nigromaculis is very important within its range and is a severe pest in irrigation districts. In districts affected, it probably ranks second to Aedes dorsalis in numbers. It ranks fifth in abundance among the mosquitoes of the state. It is a severe pest, readily attacks man and animals and inflicts painful bites.

#### AEDES PIONIPS Dyar

**DISTRIBUTION:** This species has been collected from high elevations in Glacier Park and in Gallatin County and is strictly confined to forested mountain areas.

**BIONOMICS:** This species overwinters in the egg stage. There is one generation per year. Larvae appear in the more permanent pools in dense timber and are slow in developing. Earliest adult records are from the last week in June.

**IMPORTANCE:** This mosquito is apparently reluctant to feed on man and is too rare to be of any importance.

#### AEDES PULLATUS (Coquillett)

**DISTRIBUTION:** This mosquito has been found only in timber at high elevations and never away from forests. It has been reported to occur in the Little Belt Mountains, Gallatin Canyon, and Yellowstone National Park.

**BIONOMICS:** This species is single brooded. Larvae hatch in snow water and ground depressions in the forest and in mountain meadows. At higher elevations, larvae may persist until late summer. Larvae have been collected in May at an elevation of 7,000 feet in July at 9,000 feet.

**IMPORTANCE:** Since Aedes pullatus is generally uncommon and occur in restricted localities, it is not of great importance. Although it attacks avidly and can be annoying, its bite is not severe.

#### AEDES PUNCTOR (Kirby)

**DISTRIBUTION:** In Montana this mosquito is found on both slopes of the Continental Divide and in mountain valleys, the Bridger Range, and in the Little Belt Mountains. It has never been found on the prairies.

**BIONOMICS:** There is one generation per year, overwintering in the egg stage. Aedes punctor larvae may be found in woodland pools with mossy bottoms most often formed from melting snow. Larval habitats are typically slightly acid. The average pH in waters in which they have been found tested from 6.5 to 7.0. Larvae are very resistant to cold, having been found in Alaska in a pool with a thin sheet of ice above and permafrost below. Adults are abundant from the end of May throughout

June in some timbered regions.

IMPORTANCE: This mosquito may be quite a pest in some regions. It is a persistent and severe biter, readily attacking men and animals. At times it is a problem to summer home communities as well as to stock on summer range.

AEDES RIPARIUS Dyar and Knab

DISTRIBUTION: Dyar (3) made the only collection on record at Dillon.

BIONOMICS: No observations have been made on its life history in Montana. Dyar states the larvae especially occur in early shallow spring pools on the prairie but may also be found in large pools under shrubbery. This species occurs where the forest and prairie meet but extends somewhat into each area.

IMPORTANCE: This species is very rare and of no importance in this state.

AEDES SCHIZOPINAX Dyar

DISTRIBUTION: This species has been collected from Gallatin and Jefferson Counties as well as Mammoth Hot Springs in Yellowstone National Park.

BIONOMICS: This species has one generation per year, overwintering in the egg stage. Larvae have been recovered from small depressions in cattle tracks around the edge of permanent pools and open meadows, never in a permanent pool itself. Aedes schizopinax larvae are bottom feeders and rarely come to the surface. Their larval habitat is often highly alkaline (pH 8.0), quite foul and covered with green scum. Larvae are found between April and May. Little is known of adult habits.

IMPORTANCE: This mosquito is fairly rare and of little importance in Montana.

AEDES SPENCERII (Theobald)

DISTRIBUTION: Aedes spencerii is a very common mosquito form the Yellowstone Trail at Bozeman east to North Dakota and in the northern prairie areas. It is often associated with Aedes dorsalis, Aedes vexans, and Aedes idahoensis. It is a common constituent of mosquito populations in irrigated meadows.

BIONOMICS: This species overwinters in the egg stage and has one generation per year. Larvae have been found in early May and adults taken in mid-August. Roadside ditches are favored larval habitats. It appears to thrive best in alkaline water. The earliest broods, which develop in pools formed from melting snow, are not injured by nightly freezing over of the pools. Low areas bordering rivers which are filled with seepage and high water can produce large numbers of Aedes spencerii. This species often migrates into cities and towns, though its flight range has not been determined.

IMPORTANCE: This mosquito has a high blood lust. When numerous it severely plagues rural communities, attacking even in bright sunlight. It is also a severe pest of livestock. Aedes spencerii is a mosquito of major importance in Montana due to its wide distribution and large numbers.



AEDES STICTICUS (Meigen)

DISTRIBUTION: There appears to be no records of collections west of the Continental Divide. Mail (8) states that all his records were from southern and western portions of the state.

BIONOMICS: Eggs are preferentially laid in ground depressions in cottonwood bottom lands which will receive overflow in the spring. If flooding does not occur, they ~~will~~ <sup>are known to</sup> survive ~~two or three~~ <sup>four</sup> years. Larvae are also found in backwater areas having little current. Pools in loam soil with either live or dead vegetation or both are preferred. Larvae rarely, if ever, are found in highly alkaline or mineral waters. Larval development takes from 10 days to 3 weeks depending on the temperature. Collections in Montana date from early May to late July. There is usually only one brood annually. Adults may be locally numerous following floods. The adults may live 3 months and range up to 25 or 30 miles.

IMPORTANCE: This small to medium mosquito is not numerous enough to be a great pest in Montana except in restricted areas. It readily enters houses and appears to have a strong blood lust, feeding on man, livestock, and rabbits in cloudy or shaded situations as well as in the evening.

AEDES STIMULANS (Walker)

DISTRIBUTION: This species has only been reported from Lolo Hot Springs.

BIONOMICS: Matheson (9) states that this species breeds in woodland pools, flood-pools of rivers, swamps, or marshes. This species overwinters in the egg state. Eggs hatch in melting snow and woodland pools. Adults may be found between late April and August. They feed readily in the woods at all hours.

IMPORTANCE: This is rare and is not important in Montana.

AEDES TRICHURUS (Dyar)

DISTRIBUTION: The only record of distribution was from Glacier Park.

BIONOMICS: Winter is passed in the egg stage. Larvae are found in pools resulting from melting snow and at the edges of forests. Little is known of the habits of the adults. They have been captured during the months of May and July at Glacier Park.

IMPORTANCE: This mosquito is not a problem in Montana.

AEDES TRISERIATUS (Say)

DISTRIBUTION: A single record of this species was taken at Missoula, Montana.

BIONOMICS: This is the only tree-hole mosquito of Montana. Eggs are laid singly on the sides of containers or tree-holes which are the preferred larval habitat. Winter is passed in the egg state. There may be several generations per year. Larvae develop very slowly taking nearly a month to mature. This species has a flight range of  $\frac{1}{2}$  to 1 mile.

IMPORTANCE: Adults are rare and the species is of no importance in Montana.

AEDES TRIVITTATUS (Coquillett)

DISTRIBUTION: This species is found in the prairie regions of northern and southern Montana, especially along river bottoms.

BIONOMICS: Larvae are generally found in flood pools of river bottoms and in rain filled pools in the woods. It may also be found in open semi-permanent pools in association with Aedes spencerii and Aedes vexans. The larval habitat is typically quite alkaline. Larvae have been found in water with a pH from about 8.5 to 9.0. Later larval instars spend the majority of their time concealed in vegetation at the floor of the pool. The duration of larval development is about 8 days. Adults rest among grasses and in shrubbery by day. It is mostly found in lightly wooded or open areas. They are fierce biters when disturbed or in the evening, however they do not migrate far from their breeding sites. This species overwinters in the egg stage. Howard et al. (7) believes there may be several generations per year in Montana.

IMPORTANCE: This mosquito is usually not sufficiently numerous in Montana to be important except in local areas near breeding places.

AEDES VEXANS (Meigen)  
(The Flood-Water Mosquito)

DISTRIBUTION: This species is widely distributed in the state both in open forest meadows in the mountains and on the prairies. It is generally associated with Aedes dorsalis and is nearly as numerous.

BIONOMICS: Eggs are laid singly on the ground, hatching when flooding occurs. The U. S. Department of Health, Education, and Welfare publication entitled "Mosquitoes of Public Health Importance and Their Control" states that over most of their range, Aedes vexans produce several broods each year but that in some western states where flooding occurs only in the spring they are single-brooded. In contrast, Mail (8) noted that a stimulus of sub-zero temperatures appeared to be necessary to stimulate hatching. He also stated that the rate of development of eggs of the Aedes vexans was very uneven, hatching occurring at irregular intervals. Hearle (6) observed that not all eggs hatch with a single flooding but that larvae appear periodically after alternate flooding and drying of the eggs during the course of the summer. Development of aquatic stages generally requires 10 days to 3 weeks depending on temperatures. Eggs of the Aedes vexans as well as eggs of Aedes dorsalis are very resistant to unfavorable environmental conditions. They have been observed to resist drying ~~for up to 26 months in a refrigerator~~ <sup>for up to 26 months in a refrigerator</sup>. Aedes vexans breeds in rain pools, flood waters, roadside puddles, and practically all bodies of fresh water. In Montana it is one of the dominant forms in irrigated areas. The preferred larval habitat is open sunlit pools such as in roadside ditches and flooded meadows under irrigation. This species is rarely found in shaded situations. Adults are strong fliers and commonly migrate 5 to 10 miles from their breeding sites. They are frequently collected in light traps.

IMPORTANCE: Aedes vexans ranks as the second most important pest mosquito in Montana. It occurs in enormous numbers, is very aggressive, and is a vicious biter.

ANOPHELES EARLEI Vargas

BIONOMICS: Little is known of its biology in Montana. Larvae may be collected in grassy, marginal portions of small sluggish streams and in shallow margins of semi-permanent and permanent ponds overgrown with emergent and floating vegetation. They are occasionally taken in woodland pools and marshes. Females are most active at dusk, will readily enter buildings, and attack man. The females overwinter in "hibernation". Following hibernation, females will attack even in bright sunlight.

IMPORTANCE: This species is important only in local areas in Montana.

ANOPHELES FREEBORNI Aitken  
(The Western Malaria Mosquito)

DISTRIBUTION: This species is well scattered throughout the state, having been reported from Baline County in the north to the Powder River County in the southeast and in the west on both sides of the Continental Divide.

BIONOMICS: Eggs are laid singly on the water. There may be many broods each year. The preferred larval habitat is clear, clean, slightly alkaline, semi-permanent or permanent water which is partly shaded, partly sunlit and which contains some vegetation or floating vegetation. Water polluted with sewage or other organic matter is usually avoided as is water in artificial containers. Anopheles freeborni has adapted to seepage areas, borrow pits, hoof prints, irrigation canals, and improperly irrigated fields. The adult female readily enters houses and animal shelters and bites avidly at dusk and dawn. This mosquito commonly rests during the day in cool shaded areas such as in the corners of buildings, under bridges, and in culverts. This species has an effective mid-summer flight range of 1 to 2 miles. Males usually remain within 1/4 of a mile of their breeding places. In the fall, females may migrate 10 to 12 miles and overwinter as the "hibernating" adult female in sheltered out buildings, houses, cellars, etc.

IMPORTANCE: Although this mosquito is the carrier of malaria in western United States, it is of no importance as such in Montana. There are not sufficient numbers to constitute a serious pest in Montana.

ANOPHELES PUNCTIPENNIS (Say)

DISTRIBUTION: This species has been reported from Lolo and the Bitterroot Valley on the Pacific side of the Continental Divide.

BIONOMICS: This species breeds chiefly in semi-permanent or permanent fresh water pools containing vegetation or floating debris. Larvae may be found in a variety of habitats including shallow waters of grassy bogs, swamps, sloughs, borrow pits, spring pools, artificial containers and margins of streams, preferring cool water and shaded woodland pools. There are several generations per year. Mated adult females overwinter in hibernation.

IMPORTANCE: This mosquito is reported to be a rather vicious biter out-of-doors but apparently it does not readily enter homes. The rarity of this species in Montana make it very unimportant.

CULEX PIPIENS Linnaeus  
(The Northern House Mosquito)

BIONOMICS: Culex pipiens larvae may be found in permanent or semi-permanent water with high organic matter or pollution. Eggs are laid as rafts of from 50 to 400 eggs on water. In warm weather, hatching occurs within 2 days. Larvae and pupae can complete development in 10 days. In cool weather, 2 or more weeks may be required. There may be several broods each year. Overwintering is as the adult female. This species may be found near urban communities and rural buildings where it readily enter houses. Culex pipiens may fly one mile or more, however like most domesticated mosquitoes, it will often fly only a few hundred yards. Generally larvae may be found in the vicinity of the adults. Adults are active at night and rest by day around buildings and various sheltered areas. They are readily collected by light traps. Colorado studies may indicate that birds are the preferred host (5) although they do feed on man.

IMPORTANCE: The association of Culex pipiens with human habitation make them an important lowland species even though they are only fairly common. Although not a confirmed vector in Montana, western equine and St. Louis encephalitis viruses have been isolated from wild caught specimens in Washington. It is also known to transmit the virus of fowl pox.

CULEX RESTUANS Theobald

BIONOMICS: Culex restuans usually breeds in semi-permanent or permanent fowl water containing decaying grass or leaves. Preferred larval habitat includes woodland pools, ditches, rainbarrels, tin cans, etc. Adults appear early in the spring and breed throughout the summer.

IMPORTANCE: Culex restuans is relatively unimportant in Montana.

CULEX TARSALIS Coquillett

DISTRIBUTION: Culex tarsalis has been found in many localities throughout both the prairies and in the mountains. This species is quite common in Montana.

BIONOMICS: Culex tarsalis has several generations per year. Almost any collection of temporary to semi-permanent water (usually waste water) is suitable larval habitat. Larvae are frequently found in water associated with irrigation, in for example, canals, ditches, borrow pits, impoundments, ground pools, and hoof prints. Culex tarsalis often breeds in water of high organic content such as effluent from cesspools, dairy barns or corrals, and has a wide range of tolerance to different ions. Eggs are laid as rafts on water, each female generally depositing two rafts. Eggs rafts may contain from 50 to 150 eggs. Eggs usually hatch within 2 days. Larvae and pupae develop rather rapidly. According to Hagstrom and Workman (4), at a high feeding rate and a temperature of 20° C., the average duration of larval stages 1 to 4 pupae were 3.6, 2.2, 3.2, 5.6, and 2.0 days respectively.

At the highest feeding rate and a temperature of 30° C., the duration of the larval stages were 2.9, 1.8, 2.1, and 4.9 days respectively. There may be many broods each year. Although most Culex tarsalis will remain within a mile of their breeding sites, this species has an effective flight range of between 2 and 10 miles. They usually feed from dusk to dawn and rest in secluded spots by day. Usual resting areas are in grasses and shrubs but they are frequently found on shaded sides of buildings, porches, under bridges and so forth. This species is readily taken in light traps and dry ice (carbon dioxide) traps. Adults have been collected in Montana from late June to early September. This mosquito overwinters as the engorged mated female. A blood meal is apparently needed in order to produce fertile eggs.

IMPORTANCE: Culex tarsalis is the most important vector of Western equine encephalitis virus to man and horses in Montana. To date the greatest number of such cases on record occurred in 1965 with 333 cases reported in horses and 12 in man. St. Louis encephalitis, which occurs sporadically in Montana, is also spread by Culex tarsalis. Birds, which act as a reservoir of these diseases, appear to be the preferred host of this species. However, it readily attacks cattle, horses and man.

#### CULEX TERRITANS Walker

DISTRIBUTION: This species has been reported from Glacier Park and Laurel and probably occurs over a large portion of the state.

BIONOMICS: Rather cool, deep-shaded water, with aquatic vegetation is the preferred larval habitat. However larvae may be found in a variety of situations, having been found in grassy pools, the edges of ponds where suitable shade exists, and in marshes. Eggs are laid on the water surface in the spring. There is generally only one generation per year. It overwinters as the mated female. Culex territans apparently does not bite man but feeds chiefly on frogs and snakes.

IMPORTANCE: This mosquito is rare and since it does not attack warmblooded animals, it is of no importance in Montana.

#### CULISETA ALASKAENSIS (Ludlow)

DISTRIBUTION: This species has been reported from the Gallatin Valley and from Cascade County.

BIONOMICS: The eggs of this species are laid in rafts on the surface of the water. Larvae are reported to generally be found in grassy marshes in river valleys. Mail (8) reports collecting larval from a pool formed by melting snow near woods along the Gallatin River. There is one generation per year.

IMPORTANCE: Culiseta alaskaensis is not important as it is extremely rare in Montana.

#### CULISETA IMPATIENS (Walker)

DISTRIBUTION: This species is found throughout the mountainous region along both sides of the Continental Divide.

**BIONOMICS:** This mosquito hibernates during the winter as the mated female. Eggs are laid in the spring in rafts on water surfaces of deep well shaded woodland pools and, rarely, in the open. Mail (8) located these larvae in water of a pH of from 6.8 to 7.0. This species is believed to have one generation per year. Adults are normally timid and are severe biters only for a few days immediately after emerging from hibernation. This species may be numerous in April and May but is comparatively scarce by June.

**IMPORTANCE:** This mosquito is of little importance in Montana as it is very rare and not found in heavily populated areas.

CULISETA INCIDENS (Thomson)

**DISTRIBUTION:** Culiseta incidens is found on both sides of the main range of the Rocky Mountains.

**BIONOMICS:** This species breeds in wide variety of aquatic habitats from brackish water pools to pools formed from melting snow. Larvae may be located in reservoirs, hoof prints, polluted pools, and artificial containers. Eggs are laid in long, narrow rafts preferentially on clear or semi-clear permanent pools with partial shade. This mosquito overwinters as the hibernating adult female.

**IMPORTANCE:** This species will attack cattle readily and when numerous, may be an important livestock pest.

CULISETA INORNATA (Williston)

**DISTRIBUTION:** Culiseta inornata occurs throughout the state. This is found in both open prairies and in the mountains. It is more frequently found in timbered regions.

**BIONOMICS:** This mosquito overwinters as a hibernating adult female in sheltered places. The hibernating female comes out during warm winter days and early in the spring. Breeding occurs throughout the spring and summer. Eggs are laid in boat shaped masses on the water surface. Larvae are frequently found in very cold water. Permanent pools are preferred breeding places although semi-permanent water may also be used. The first generations develop somewhat slowly in the spring due to the low temperatures of most pools. But later in the summer development is much more rapid. Earliest larval collections have been made in Montana on June 3 at an elevation of 7,000 feet. Larvae can live under a wide variety of conditions having been taken not only from very cold water but, as Mail (8) reports, from warm sulphur water where each instar was coated with a deposit of sulphur. Adults have been collected from June to September. They are often associated with Culex tarsalis.

**IMPORTANCE:** Culiseta inornata does not ordinarily attack man but can be troublesome if numerous. It can annoy cattle and sheep and be an economic pest. Although this species has been found to be naturally infected with western equine encephalitis virus its feeding makes it unlikely to be an important vector to man.

MANSONIA PERTURBANS (Walker)

DISTRIBUTION: This species has been collected at Bigfork. Little else is known of its distribution in Montana.

BIONOMICS: This species lays eggs in rafts on marshes, ponds, and lakes with thick, aquatic vegetation. Larvae may be found in association with cattail and water sedges. Larvae remain below the surface breathing through tubes which are adapted for penetrating the plants from which they get their air. Larvae develop slowly. Mansonia perturbans overwinters as larvae attached to roots of plants. There is only one generation per year. Following a 5 or 6 day pupal period adults emerge in the spring. They have an effective flight range of 1 to 5 miles or more. Females readily enter houses and bite viciously. They are principally active at dusk and the early part of the evening.

IMPORTANCE: Mansonia perturbans is too rare in Montana to be of any importance.

PSOROPHORA SIGNIPENNIS (Coquillett)

DISTRIBUTION: This species is found in arid river valley areas of northern and southern Montana prairies.

BIONOMICS: Little is known of the life history of this mosquito. Presumably, it passes the winter in the egg state. This species is well adapted to breeding in temporary pools. Larvae have been found in roadside and rain pools. Under favorable conditions, it may develop from egg to adult in 5 days. There may be several generations each year. The adult female bites readily and inflicts a painful bite.

IMPORTANCE: This species is too rare to be a major importance in Montana.

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