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SEASONAL SUCCESSION AND RELATIVE ABUNDANCE OF MOSQUITOES ATTACKING CATTLE IN CENTRAL ALBERTA

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ABSTRACT. At George Lake, 63 km northwest of Edmonton, Alberta, from April to September 1973-75, mosquitoes were caught from cattle in the open and from a calf-baited stable trap. Mosquitoes of 15 species or species groups were collected in nearly the same proportions in the stable trap as on cattle in the open. Combined attack rates of all species were highest in late July and early August when the mosquitoes arrived at a tethered calf faster than they could be collected. The stable trap caught more mosquitoes, but still underestimated the relative abundance of some species because it hindered their entry. The most abundant mosquitoes were *Aedes vexans*, *Ae. communis* group, *Culiseta inornata*, *Cs. alaskaensis*, *Ae. spencerii*, *Ae. fitchii* group and *Ae. flavescens*. Cattle in fields were severely disturbed by mosquitoes in late May (chiefly *Ae. spencerii*), and from mid-July to early August (chiefly *Ae. vexans*, *Ae. spencerii* and *Cs. inornata*).

INTRODUCTION

In central Alberta, mosquitoes are sometimes severe enough pests to stop cattle feeding and to provoke stampedes in which calves are killed. Four plagues of mosquitoes from June to September 1973 were estimated to have cost \$31 million in reduced weight gains of beef cattle (Dixon 1974). The pest species in 1973 were *Aedes vexans* (Meigen) and *Ae. dorsalis* (Meigen).

During a study of the seasonal biology of *Anopheles*, *Culex*, and *Culiseta* mosquitoes,¹ females were collected from cattle because they rarely or never came to man.

MATERIALS AND METHODS

STUDY AREA. Mosquitoes were caught on a farm at George Lake, 60 km northwest of Ed-

monton, Alberta, from April to September during 1973-75. George Lake lies in a transition zone between aspen parkland and boreal forest (taiga) where large areas have been cleared for pasture, hay and grain fields. The farm had about 100 dairy and beef cattle of various breeds at the time of the study.

COLLECTING METHODS. From April to September 1973 and from April to June 1974, female mosquitoes were caught by aspirator from 10-20 unrestrained calves in a feedlot and a pasture next to the farmyard. However, when mosquitoes were abundant, the cattle would not allow the collectors to go near them and sometimes stampeded. For the rest of 1974 and the entire 1975 season, mosquitoes were caught from single calves, haltered and tied to a fence post. Dairy calves of various breeds, weighing 150-400 kg, were used to attract mosquitoes. Catch periods were from sunset to one hr after sunset in summer, and from 2-3 hr before to one hr after sunset in spring and fall. Civil twilight lasted 37-55 min, so catches were completed with the aid of a flashlight. The results

¹ Hudson, J. E. 1977. Seasonal biology of *Anopheles*, *Culex* and *Culiseta* in central Alberta (Diptera: Culicidae). Ph.D. thesis, University of Alberta. 388 pp.

have been expressed as numbers per collector per hour.

An "Egyptian" type stable trap (Bates 1944) was used in August and September 1974 and from May to September 1975. The trap was 2 m long, 1 m wide and 1.8 m high, with the frame, roof and lower walls of wood and the upper walls (above 1 m) covered with 1.6 mm mesh flyscreen. On each of the long sides, the lower 38 cm of the screened portion sloped 20 cm inwards to a horizontal entry slit 2 cm wide. A haltered calf was kept in the trap, usually from one hr before sunset to 4-5 hr after sunrise. Mosquitoes were collected by aspirator from the trap after the calf had been removed.

Captured mosquitoes were identified using keys by Carpenter and LaCasse (1955). Nomenclature follows Wood et al. (1979). Ovaries of some of the *Anopheles* and *Culiseta* females were dissected to determine their condition (diapausing, nulliparous or parous).

RESULTS

Fifteen species or species groups of mosquitoes were identified from cattle during the study (Table 1). The most abundant species each year was *Aedes vexans*, followed by *Ae. communis* group, *Culiseta inornata* (Williston), *Cs. alaskaensis* (Ludlow), *Ae. spencerii* (Theobald),

Ae. fitchii group, and *Ae. flavescens* (Müller). Cattle were attacked by mosquitoes from late April to September (Fig. 1). Combined attack rates for all species were highest in late July and early August, at times exceeding 400 per man-hour. During periods of peak abundance, not all mosquitoes could be caught by a single collector and the calves themselves were very disturbed and uncooperative.

The stable trap also underestimated mosquito abundance because some of the mosquitoes did not enter. On 14 May 1975, between 2000 and 2200 hr (sunset 2030 hr), 17 *Cs. alaskaensis* and 2 *Anopheles earlei* Vargas females arrived and sat on the outside of the trap, but only 9 *Cs. alaskaensis* and no *An. earlei* were found inside the trap next morning. Moreover, the total number of mosquitoes taken in 12 all-night catches, lasting 12-14 hr each, with the bait trap (2148) was not much greater than the number (1727) taken from a tethered calf nearby in 12 one-hr catches starting at the same times as the bait trap catches (Table 1). Of the 4076 mosquitoes taken in the bait trap in two summers, 3503 (86%) were engorged.

Aedes communis group females first appeared in late May and were abundant until early August. They were not identified to species, but *Ae. communis* (DeGeer), *Ae. cataphylla* Dyar, *Ae. punctator* (Kirby), *Ae. abserratus* (Felt and Young),

Table 1. Mosquitoes collected from cattle and from calf-baited stable trap, George Lake, Alberta, 1973-75.

Species	May-Sept. 1975 (12 nights)				Combined catches from cattle in open 1973-75		
	On calf (one hour)		Stable trap (all night)		Total*	Earliest date	Latest date
	No.	%	No.	%			
<i>Aedes</i>							
<i>canadensis</i>	0	0.00	1	0.05	2	23/7	26/8
<i>cinereus</i>	35	2.03	1	0.05	43	6/6	19/8
<i>communis</i> group	186	10.77	358	16.67	449	22/5	26/8
<i>dorsalis</i>	10	0.58	15	0.69	39	9/7	6/9
<i>excrucians</i>	18	1.04	14	0.65	42	17/6	26/8
<i>fitchii</i> group	18	1.04	35	1.63	228	6/6	6/9
<i>flavescens</i>	11	0.64	18	0.84	188	18/6	27/8
<i>riparius</i>	1	0.06	0	0.00	17	18/6	27/8
<i>spencerii</i>	34	1.97	142	6.61	256	22/5	3/9
<i>vexans</i>	1221	70.70	1325	61.68	3018	24/6	6/9
unidentified	6	0.36	4	0.19	11	—	—
<i>Anopheles</i>							
<i>earlei</i>	5	0.29	15	0.69	32	23/4	23/7
<i>Mansonia</i>							
<i>perturbans</i>	1	0.06	16	0.74	10	25/6	20/8
<i>Culiseta</i>							
<i>alaskaensis</i>	74	4.28	94	4.33	372	23/4	6/8
<i>inornata</i>	107	6.19	110	5.12	1550	22/5	21/8
<i>morsitans</i>	0	0.00	0	0.00	1	3/9	3/9
Totals	1727	100.01	2148	100.04	6258	23/4	6/9

* Includes some catches for *Anopheles* and *Culiseta* spp. only.

Ae. diantaeus Howard, Dyar and Knab, *Ae. hexodontus* Dyar, *Ae. implicatus* Vockeroth, *Ae. intrudens* Dyar, *Ae. pionips* Dyar, *Ae. provocans* (Walker), *Ae. pullatus* (Coquillett), and *Ae. sticticus* (Meigen) have all been recorded from George Lake [R. A. Ellis (personal communication 1973) for *Ae. aberratus*; Graham (1969) for the other species].

The *Aedes fitchii* group includes all the mosquitoes that keyed to *Ae. fitchii* (Felt and Young) in Carpenter and LaCasse (1955) and may have included *Ae. evedes* Howard, Dyar and Knab, and/or *Ae. mercurator* Dyar; both of which are now known to occur in central Alberta (Wood et al. 1979). *Aedes fitchii* group females were first caught in early June, reached their peak in mid-June and decreased in abundance

gradually (Fig. 1). A few were still taken in early September.

Aedes flavescens females were caught in moderate numbers from mid-June to early August and in smaller numbers until late August. *Ae. flavescens* females were mainly diurnal biters in the study area, and were therefore underrepresented in the catches.

Seasonal captures of *Ae. spencerii* females showed three peaks, in late May, July and late August, which may have represented three generations as *Ae. spencerii* is multivoltine (Wood et al. 1979). In late May 1974, there was a plague of *Ae. spencerii*. On the evening of the 22 May, 300–500 females were seen on the flanks of one calf which, like the rest of the herd, was too restless to allow capture of many

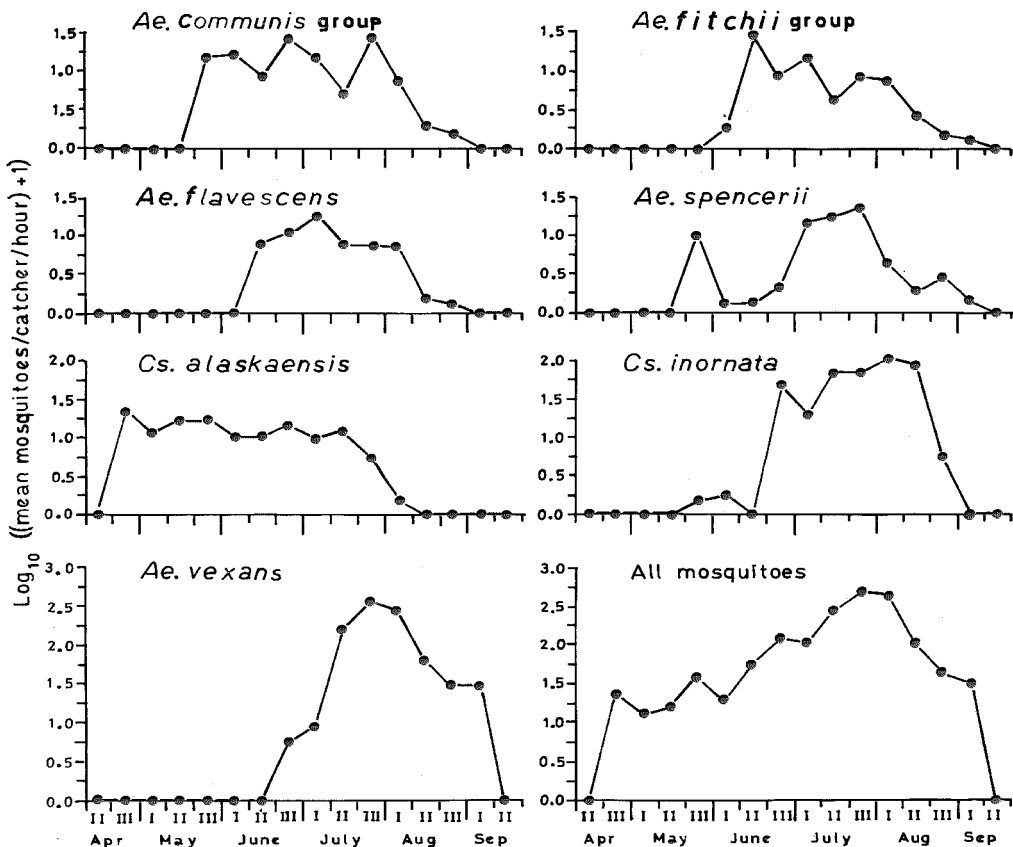


Fig. 1. Mean catch rates, per man-hour, of mosquitoes from cattle outdoors, George Lake, Alberta, 1973–75. Total catch sizes are shown in table 1, column 5. Results are grouped by decades (I, II, III) of each month.

mosquitoes. Since *Ae. spencerii* is also mainly a diurnal biter, its importance as a pest may have been underestimated by the catches.

Aedes vexans females appeared in late June, and were the most serious pests, with a peak from mid-July to mid-August. This species is multivoltine, and in 1975 there was one plague in mid-July and another in late September. Females were taken biting at 8°C but not at 6°C. Night temperatures at George Lake often went below 5°C, even in July, so the cattle would then have had some respite from *Ae. vexans*.

Overwintered females of *Cs. alaskaensis* were the first mosquitoes to attack cattle each spring during the snowmelt period (late April or early May), and they continued to appear in large numbers on cattle until mid-July. *Culiseta alaskaensis* is univoltine; females have an obligate diapause and do not take blood until the following year (Wood et al. 1979). At George Lake, the diapausing females began to emerge from pupae in mid-June, but they were never taken on cattle. All the *Cs. alaskaensis* caught on cattle in July were parous females, by then a year old and reproductively active for two months.

A few overwintered females of *Cs. inornata* were caught from cattle in late May and early June. Many females of the first summer generation came to cattle in late June, shown by an increase in the proportion of nullipars. Biting rates continued high until mid-August, after which they dropped abruptly due to the onset of diapause in the population.

DISCUSSION

Attack rates on calves in the open were not measured precisely, because the mosquitoes arrived faster than a single collector could catch them. The collector and his flashlight may have also been attractants. Slightly more mosquitoes were caught in the stable trap than on a calf in the open, but certain species (e.g. *Cs. alaskaensis*) were underestimated in the stable trap catches because they did not readily enter it. Although 86% of the mosquitoes caught in the stable trap were engorged, it cannot be taken for granted that all of them had fed on the calf in the trap, nor that they would have fed on the calf in the open. Moreover, the calf in the stable trap was partially concealed and prevented from normally foraging. Shemanchuk's method (1978) of using a trap with sides that can be rolled up

completely to allow mosquito entry, and of letting the calf walk over the pasture before entering the trap, probably more accurately represents the relative abundance of blood-sucking Diptera attacking cattle.

For large hosts such as cattle, loss of weight during periods of mosquito attack is due more to irritation and interruption of grazing than to direct blood loss. The critical attack rate at which cattle stop feeding probably varies with the hunger of the cattle, previous exposure to mosquitoes, presence of other biting flies, and other factors. In late July each year, the combined attack rates certainly exceeded the critical level, and the attack rates of *Ae. vexans* alone probably exceeded it. Other mosquitoes may be important in their own right if they are abundant when *Ae. vexans* is absent, for example *Cs. alaskaensis* in April and *Ae. spencerii* in May.

ACKNOWLEDGMENTS

I thank the Donald family of George Lake for their help throughout the study, and R. H. Gooding, University of Alberta, and J. A. Shemanchuk, Agriculture Canada, Lethbridge, for reviewing the manuscript. The study was aided by grants from the Boreal Institute for Northern Studies, University of Alberta, (to J.E.H.) and the Pesticide Chemicals Branch, Alberta Environment (to R.H.G.).

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