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SNOWSHOE HARE VIRUS INFECTIONS IN CANADIAN ARCTIC MOSQUITOES DURING 1980[1]

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ABSTRACT. Snowshoe hare (SSH) virus (California encephalitis group) was isolated from 7 of 162 pools comprising 7472 unengorged adult female mosquitoes of 3 species which were collected throughout the Yukon Territory between 9 June and 30 July 1980. All isolates were achieved from *Aedes communis* mosquitoes, with isolations ranging from 1:78 to 1:483 mosquitoes collected at southern Yukon locations (61°N) and 1:182 to 1:382 at northern Yukon locations (66°N, 137 to 138°W) along the recently constructed Dempster Highway.

INTRODUCTION

Attempts to define the ecology of two Bunyaviruses, snowshoe hare (SSH) virus (California encephalitis group) and Northway (NOR) virus (Bunyamwera group) have been undertaken annually since 1971 throughout portions of the western Canadian arctic which are accessible by road (McLean et al. 1975, 1979a). These investigations were stimulated by the isolation of these 2 mosquito-borne arboviruses in adjacent portions of Alaska during 1970 (Ritter and Feltz 1974). This report confirms the enzootic prevalence of SSH virus at intensively studied foci at southern and northern locations in the Yukon Territory, and identifies a new focus of infection along the northern extension of the Dempster Highway which was first opened to private automobiles during autumn 1978.

METHODS

Unengorged adult female mosquitoes were collected by hand aspirators at 13 locations in the Yukon Territory at latitudes 60 to 67°N from 9 June to 30 July 1980, and at Inuvik, Northwest Territories (69°N, 135°W) on 22 July 1980.

Mosquitoes were sealed immediately in glass tubes and stored at −70°C in styrofoam containers with dry ice, in which they were transported by air to Vancouver. They were held frozen at

[1] Supported by National Research Council Canada, Contract No. OSU79-00019.

−70°C until tested during the succeeding 2 months. Pools comprising 1 to 74 mosquitoes (usually 50 to 60) of the same species were ground up, extracted with 2 ml diluent comprising 20% fetal calf serum in Eagle's minimal essential medium, and assayed for virus content by intracerebral injection of newborn mice as described previously (McLean et al. 1972). Virus isolates were typed by mouse neutralization tests using type-specific antisera prepared in rabbits by single intravenous injections with Yukon prototypes of SSH and NOR viruses (McLean et al. 1972, 1975, 1979a).

RESULTS

From 7472 mosquitoes of 3 species collected throughout the Yukon Territory and in the adjacent portion of the Northwest Territories at Inuvik, 7 strains of SSH virus were recovered from 162 mosquito pools (Table 1). All isolates were achieved from *Aedes communis* mosquitoes, which showed virus titers of 3.0 to more

Table 1. Snowshoe hare virus isolations from Canadian Arctic mosquitoes, 1980.

Locality	Week No.	Date	Mosquito Species			Total
			Ae. com.	Ae. hex.	Cs. in.	
Marsh Lake	24	9 June	1/483S (4.0+)	0/125	0/85	1/693
61°N 134°W	25	20 June	0/165	0/58	0/2	0/225
	26	26 June	1/100S (4.0+)	0/18	0/16	1/134
	27	3 July	1/196S (4.0+)	0/54	0/11	1/261
	28	9 July	0/60	0/13	0/1	0/74
	29	14 July	1/78 S (4.0+)		0/1	1/79
Fish Lake Rd	25	18 June	1/183S (3.5)	0/59	0/36	1/278
61°N 135°W	26	3 July	0/215	0/63	0/16	0/294
Carcross Rd						
60½° N 135°W	26	28 June	0/80	0/25	0/4	0/109
Lake Lebarge	23	10 June	0/13	0/5	0/3	0/21
61½°N 135°W	25	18 June	0/161	0/77	0/19	0/257
Carmacks						
62°N 136°W	27	3 July	0/15		0/5	0/20
Kusawa Lake						
61°N 136°W	25	19 June	0/253	0/85	0/13	0/351
Dempster Hwy						
Km 68 (65°N 138°W	29	17 July	0/122	0/32		0/54
Km 197 (66°N 138°W)	29	16 July	1/382S (3.5)	0/116		1/498
Km 197 (66°N 138°W)	31	30 July	0/132	0/10		0/142
Km 212 (66°N 138°W)	31	29 July	0/99	0/10	0/1	0/110
Km 222 (66°N 138°W)	29	16 July	0/583	0/85		0/668
Km 222 (66°N 138°W)	31	29 July	0/438	0/76		0/514
Km 236 (66°N 137°W)	31	29 July	1/182S (3.0)	0/41		1/273
Km 281 (66°N 137°W)	29	16 July	0/141	0/23		0/164
Km 371 (67°N 137°W)	29	16 July	0/605	0/108	0/1	0/754
Inuvik 69°N 135°W	30	22 July	0/1086	0/360	0/3	0/1449
Total			7/5772	0/1483	0/217	7/7472

S Snowshoe hare virus isolated (log_{10} mouse LD_{50} virus per mosquito pool is indicated in parentheses).

7472 mosquitoes were tested in 162 pools of size 1–74 mosquitoes.

Ae. com.: *Aedes communis.*

Ae. hex.: *Aedes hexodontus.*

Cs. in.: *Culiseta inornata.*

than 4.0 $\log_{10}$ mouse LD_{50} per pool. This newborn mouse system detects a minimum of 2.0 $\log_{10}$ mouse LD_{50} per mosquito pool.

Detection of virus in mosquitoes ranged from 1:78 collected at Marsh Lake (61°N, 134°W) on 14 July to 1:483 *Ae. communis* at the same location on 9 June. In the southern Yukon Territory (61°N), SSH virus was detected during 5 weeks of the 6-week collection period at Marsh Lake and nearby Fish Lake Road. In the northern Yukon Territory SSH virus was recovered from 1:382 *Ae. communis* collected along the Dempster Highway at Km 197 (66°N, 138°W) on 16 July, and from 1:182 mosquitoes at a new location Km 236 (66°N, 137°W) on 29 July.

DISCUSSION

Isolation of SSH virus from *Ae. communis* mosquitoes obtained at Marsh Lake (McLean 1980) during 5 of 8 summer collection periods between 1972 and 1980 (Table 2), demonstrates the existence of an enzootic focus at this boreal forest location along the well-travelled Alaska Highway in the southern Yukon Territory. Probable summertime vertebrate reservoirs are snowshoe hares and arctic ground squirrels (McLean et al. 1975). Recovery of SSH virus from *Aedes* sp. larvae collected at this location during spring 1975 (McLean et al. 1977) suggests overwintering by transovarial transfer. Detection of SSH virus in mosquitoes collected during the same 5 summers in the boreal forest along the Dempster Highway at Km 197 (McLean 1980) indicates enzootic prevalence at that location also. Although significant numbers of *Culiseta inornata* were not collected along the Dempster Highway during 1980, SSH virus was recovered from 1:73 *Cs. inornata* during 1978 (McLean et al. 1979a). Persistence of SSH virus in *Cs. inornata* mosquitoes which were held as long as 329 days at 4°C (McLean et al. 1979b) suggests that this virus may overwinter in adult mosquitoes.

Although no clinically manifested human cases of central nervous system infections by SSH virus have yet been documented in the Yukon Territory, subclinical infections have been identified in adjacent portions of Alaska (Ritter and Feltz 1974). Serological evidence of concurrent infection with SSH virus in humans who developed aseptic meningitis or encephalitis in eastern Canada during 1978 in the Province of Quebec (Fauvel et al. 1980) and both in Quebec and in a region of southern Ontario during 1980 (Artsob, H., personal communication, September 1980), where SSH virus has

Table 2. Snowshoe hare virus isolates from mosquitoes at two Yukon locations, 1972–1980.

	Marsh Lake (61°N, 134°W)					Dempster Hwy Km 197 (66°N, 138°W)				
Week No.	1972	1973	1974	1978	1980	1972	1973	1974	1978	1980
24	0/157		0/191	0/500	1/483		1/370§			
25	0/450		0/148		0/165					
26		0/433	0/149		1/100	0/692		0/459		
27	1/663	1/459	0/133	2/336	1/196					
28	1/1029					0/60		0/1034		
29	0/138	1/59*	0/234	0/808	1/78			3/490		1/382
30						1/1265			2/1318 3/220†	
31	2/284									0/132

All mosquitoes were *Aedes communis* unless otherwise indicated.
* *Aedes canadensis.*
§ *Aedes cinereus.*
† *Cs. inornata.*
These two locations are illustrated (McLean 1980).

been recovered from 4 *Aedes* species (Thorsen et al. 1979), strongly suggests potential hazards to human health in these persistent foci of SSH virus infection along the Alaska and Dempster Highways of arctic Canada.

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