

- (Diptera: Ceratopogonidae) at Vero Beach, Florida. Ann. Entomol. Soc. Amer 63: 1332-1339.
- Myers, J.G. 1932. Report on the sand fly (*Culicoides*) investigations in the Bahamas. Bahamas Govt. Pub. Nassau. 18 pp.
- Myers, J.G. 1935. The sand fly pest. (*Culicoides*). Trop. Agric. 12: 71-73.
- Painter, R.H. 1927. The biology, immature stages and control of the sand flies (biting Ceratopogonidae) at Puerto Castilla, Honduras. Rep. Un. Fruit. Co. Med. Dept. 15: 245-262.
- Shields, S.E. and Hull, J.B. 1943. The seasonal incidence of sand flies in Florida. J. Econ. Entomol. 36: 625-626.
- Sudia, W.D. and Chamberlain, R.W. 1962. Battery operated light trap, an improved model. Mosquito News 22: 126-129.
- Swabey, C. and Lewis, C.B. 1946. Forestry in the Cayman Islands. Devel. & Welfare in the W. Indies (Barbados) Bull. 23.
- Tikasingh, E.S. 1972. Seasonal and diurnal activities of four species of Trinidad *Culicoides* (Diptera: Ceratopogonidae). Mosquito News 32: 447-452.
- Wall, W.J. and Doane, O.W. 1960. A preliminary study of the bloodsucking Diptera on Cape Cod, Massachusetts. Mosquito News 20: 39-44.
- Williams, R.W. 1962. Observations on the bionomics of *Culicoides furens* (Poey) on St. John, U.S. Virgin Islands (Diptera: Ceratopogonidae). Mosquito News 22: 155-157.
- Williams, R.W. 1964. Observations on the habitats of *Culicoides* larvae in Trinidad, W.I. (Diptera: Ceratopogonidae). Ann. Entomol. Soc. Amer 57: 462-466.
- Wirth, W.W. and Blanton, F.S. 1959. Biting midges of the genus *Culicoides* from Panama (Diptera: Heleidae). Proc. U.S. Natn. Mus. 109: 237-482.
- Woke, P.A. 1954. Observations on Central American biting midges (Diptera: Heleidae). Ann. Entomol. Soc. Amer 47: 61-74.

NOTE ON CULICIDAE OF THE UPPER RICHELIEU, QUEBEC

M. DURAND AND D. DE OLIVEIRA

Département des Sciences biologiques Université du Québec à Montréal,
C.P. 8888, Succ. "A" Montréal, Qué. H3C 3P8

ABSTRACT. A bi-weekly sampling of primarily larval mosquito populations was done during the 1975 season in the Upper Richelieu region. This study revealed the presence of 23

species of Culicidae, constituting nearly 50% of species known in Quebec. Data are given on the abundance and distribution of these species.

INTRODUCTION

Studies of the importance of the spring floods on the ecology of the Richelieu River (G.R.E.R. 1974) have stimulated our interest in the local mosquito populations. Work has been done on mosquitoes throughout the province of Quebec (Twinn 1949), and, more recently on those of the southern portion of the province (Bourassa et al. 1976), but no detailed study has been carried out on the Upper Richelieu region to the southeast of Montreal (45°10' N; 73°16' W). A 10 mile

long sector of the Richelieu Valley, from the Canadian-American border to St-Paul de l'Île-aux-Noix, was visited regularly.

MATERIALS AND METHODS

Mosquito larvae were collected during 1975, using a 1-litre dipper. Larvae were identified at the 4th instar using the keys of Carpenter and LaCasse (1955), Rempel (1950) and Steward and McWade (1961). Although we were primarily interested in larval populations, adults were also collected, using emergence traps and

entomological nets. The adult specimens were identified by Dr. D.M. Wood, Biosystematics Research Institute, Agriculture Canada.

RESULTS

During 8 months of sampling at 16 stations distributed so as to cover a large part of the territory, 23 species in 5 genera were found (Table 1). The number of spe-

Table 1. List of mosquito species collected on the Upper Richelieu (A: abundant; C: common; O: occasional; R: rare)

Species	Abundance
<i>Aedes (Aedes)</i>	
<i>cinereus</i> Meigen	C
<i>Aedes (Aedimorphus)</i>	
<i>vexans vexans</i> (Meigen)	A
<i>Aedes (Ochlerotatus)</i>	
<i>aurifer</i> (Coquillett)	A
<i>barri</i> Rueger	R
<i>canadensis canadensis</i> Theobald	C
<i>communis communis</i> (De Geer)	R
<i>dorsalis</i> (Meigen)	C
<i>excrucians</i> (Walker)	C
<i>fitchii</i> Felt & Young	C
<i>flavescens</i> (Miller)	O
<i>intrudens</i> Dyar	O
<i>riparius</i> Dyar & Knab	R
<i>sticticus</i> (Meigen)	R
<i>stimulans</i> (Walker)	C
<i>trichurus</i> (Dyar)	R
<i>Anopheles (Anopheles)</i>	
<i>earlei</i> Vargas	A
<i>punctipennis</i> (Say)	C
<i>quadrimaculatus</i> Say	O
<i>Culex (Culex)</i>	
<i>pipiens pipiens</i> Linnaeus	R
<i>restuans</i> Theobald	O
<i>Culex (Neoculex)</i>	
<i>territans</i> (Walker)	A
<i>Coquillettidia (Coquillettidia)</i>	
<i>perturbans</i> (Walker)	R
<i>Uranotaenia</i>	
<i>sapphirina</i> (Osten Sacken)	O

cies found in this preliminary study is equal to nearly 48% of the total number of mosquitoes species tabulated so far in the province (Harrison and Cousineau 1973).

LARVAE. The immature stages were found at widely varying densities, and their spatial and temporal distribution also varied (Table 2). The *Aedes* species are most abundant during April and the first 2 weeks of May, when they are found in temporary habitats dominated by herbaceous plants (*Typha latifolium* L., *Poa pratensis* L. et *Sparganium eurycarpum* Engelm). *Aedes vexans* was detected over a larger period than the other species (Table 2), from mid-May until November 6; numerous adults were also captured during this period. It seems that this species may produce several generations in this region, where the number of degree-days is the highest in the province (Rousseau

Table 2. Temporal distribution of mosquitoes collected on the Upper Richelieu

Species	Larvae	
	1 *	2 *
<i>Aedes aurifer</i>	04-22-75/05-20-75	
<i>Aedes barri</i>	04-16-75/04-22-75	
<i>Aedes canadensis</i>	04-22-75/05-13-75	
<i>Aedes cinereus</i>	04-25-75/05-16-75	
<i>Aedes communis</i>	04-25-75	
<i>Aedes dorsalis</i>	04-22-75/09-05-75	
<i>Aedes excrucians</i>	03-16-75/05-20-75	
<i>Aedes fitchii</i>	04-16-75/05-20-75	
<i>Aedes flavescens</i>	05-05-75/05-13-75	
<i>Aedes intrudens</i>	05-13-75/05-16-75	
<i>Aedes riparius</i>	04-25-75/05-16-75	
<i>Aedes sticticus</i>	04-25-75/05-05-75	
<i>Aedes stimulans</i>	04-25-75/05-13-75	
<i>Aedes trichurus</i>	04-25-75	
<i>Aedes vexans</i>	04-25-75/11-06-75	
<i>Anopheles earlei</i>	06-17-75/10-18-75	
<i>Anopheles punctipennis</i>	05-13-75/11-06-75	
<i>Anopheles</i>		
<i>quadrimaculatus</i>	07-10-75/10-18-75	
<i>Culex restuans</i>	05-13-75/09-22-75	
<i>Culex pipiens</i>	09-05-75/09-18-75	
<i>Culex territans</i>	06-17-75/11-06-75	
<i>Coquillettidia perturbans</i>		
<i>Uranotaenia sapphirina</i>	07-04-75/08-05-75	

* (1) First and (2) last date of collection.

1974). An observation supporting this interpretation is the detection of *Anopheles punctipennis* in mid-May, despite the fact that in Canada this species ordinarily makes its appearance later (Steward and McWade 1961). A temporal and spatial association appears to exist between larvae of *An. punctipennis* and *Ae. aurifer*, found together in partly shaded areas with a high water level (1.5 m.).

Summer and autumn species were of the genera *Culex*, *Anopheles* and *Uranotaenia*, found principally in wooded, permanently flooded areas, and in ditches at the side of the road. Although some of these species are found at low densities and in restricted locations, they seem to be well established in the region. For example, large numbers of *An. quadrimaculatus* and *Uranotaenia sapphirina* were found in 1975 and 1976, but only along the American border and at Ash Island.

Among *Culex* species, only *Culex territans* was found in abundance; the rarity of *Cx. pipiens* can be explained by the lack of habitats appropriate for this species.

ADULTS. *Aedes* predominated among adults as among immature forms; species were *Ae. vexans*, *Ae. stimulans*, *Ae. cinereus* and *Ae. aurifer*. The adults emerge about a week after the larval population reaches its peak, and constitute a source of great annoyance in the forests, *Ae. aurifer* particularly.

The adult collections demonstrated the presence of *Coquillettidia perturbans* near the Riviere du Sud, where the very dense colonies of *Zizania aquatica* L. and *Phragmites communis* Trin. could be ideal habitats for the larval stages.

CONCLUSION

This study although limited in time and

coverage has nevertheless demonstrated the presence of nearly 50% of the species known to inhabit the province. One-quarter of these are known vectors of diseases of man and domesticated animals.

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Bibliography

- Bourassa, J.P. et al., 1976. Nouvelles données sur la chorologie et l'écologie de quelques espèces de Culicidae (Dipteres) dans le Québec méridional. *Can. Ent.* 108:731-735.
- Carpenter, S.M. and J. LaCasse. 1955. Mosquitoes of North America. Univ. of Calif. Press, Berkeley, 360 pp.
- G.R.E.R. 1975. Rapport sur l'état des recherches en écologie du Haut-Richelieu. Sciences biologiques, U.Q.A.M., Montréal, Que.
- Harrison, R.J. et G. Cousineau. 1973. Les moustiques au Québec, leur importance médicale, vétérinaire, économique et la nécessité d'un programme de démoustication. *Ann. Soc. Entomol. Qué.* 18(3):138-146.
- Rempel, J.G. 1950. A guide to the mosquito larvae of western Canada. *Can. J. of Res., Ser. D.* 28(4):207-248.
- Rousseau, C. 1974. Géographie floristique du Québec. Labrador. Distribution des principales espèces vasculaires. Presses de l'Université Laval. pp. 789.
- Steward, C.C. et J.W. McWade. 1961. The Mosquitoes of Ontario (Diptera: Culicidae) with keys to the species and notes on distribution. *Proc. Ent. Soc. Ont.* 91:121-188.
- Twinn, C.R. 1949. Mosquitoes and mosquito control in Canada. *Mosquito News* 9(2):35-41.