hereby extends sincere thanks to the survey and larvicide crews of the 3 counties involved, for their dedicated performance in carrying out the field work.

Literature Cited

Joseph, S. R. 1976. Temporary mosquito control in Maryland. Mosquito News 36 (1):27–30.

Nelson, J. H., E. C. Evans, Jr., N. E. Pennington and M. V. Meisch. 1976. Larval control of *Psorophora confinnis* (Lynch-Arribálzaga) with a controlled-release formulation of Chlorpyrifos. Mosquito News 36 (1):47–51.

A NEW RECORD OF *AEDES CANTATOR* FROM THE TIDAL ZONE OF SOUTHEASTERN JAMES BAY, QUEBEC

ALAIN MAIRE AND YVES MAILHOT

Groupe de recherche sur les insectes piqueurs, Université du Québec à Trois-Rivières, C.P. 500, Trois-Rivières, Qué.

ABSTRACT. Very high densities of *Aedes cantator* larvae were observed all along the tidal zone of the southeastern part of James Bay, Quebec. Thus, its distribution is greatly extended westwards: it was formerly known only on the Atlantic Coast, from Goose Bay to Virginia. The ecology of larval breeding sites of *Ae. cantator* are analysed and discussed. The associated mosquito species are *Ae. implicatus* during the spring and *Ae. dorsalis* which follow in the same larval habitats during the summer. Two possible mechanisms of dispersal of *Ae. cantator* to James Bay are suggested.

RÉSUMÉ. *Aedes cantator* a été observé en très grande densité le long de la zone littorale de la Baie de James, jusqu'à Eastmain. Son aire connue jusqu'alors formait une bande littorale atlantique, de Goose Bay jusqu'en Virginie. L'étude écologique des gîtes à larves d'*Aedes cantator* de la Baie de James est présentée et discutée. Les deux espèces culicidiennes associées sont *Ae. implicatus* au printempts et *Ae. dorsalis*, qui succède en été à *Ae. cantator* dans les mêmes gîtes. A la suite des résultats obtenus, les auteurs proposent une nouvelle aire de répartition pour cette espèce.

Aedes (Ochlerotatus) cantator (Coquillett) is confined to the Nearctic region. Its distribution was thought to be restricted to the Atlantic coastal zone, from Goose Bay, Labrador (Canadian National Collection (CNC) Ottawa, collected in 1949 by R. P. Thompson), Newfoundland (Vockeroth 1954) and the Maritime Provinces (Twinn 1949) south along the eastern coast of U.S. (Horsfall 1955, Main et al. 1968, Evans and McCuiston 1971; Bickley et al. 1971) to Virginia (Gladney and Turner 1969). According to Horsfall (1955), "Larvae are found in shallow, sodded depressions when these are flooded by freshwater or by brackish water." Evans and McCuiston (1971) report that "according to Headlee (1945), *A. cantator* breeds in fresh, salt or brackish water but prefers water pools formed by rain or drainage."

This species has a springtime larval development (Bickley et al. 1971). Although Horsfall (1955) considers it as a multivoltine species, Saugstadt et al. (1972) note in Virginia that "*Aedes cantator* adults reached peak density in the spring and were present in very low numbers during the summer. This observation is in contrast to reports of its being a multivoltine species in other areas." But this far south there are 3 other saltmarsh species competing with *Ae. cantator*, and the climate is different. We observed larvae only during the spring (June 1977). On the other hand, adult specimens in the CNC, collected from 12 localities in the Maritime Provinces, were taken mostly during the months of June and July. Only one mention is noted from September 3, 1974 (D. M. Wood, Sackeville, N.B.).

Ae. cantator was not collected during the only previous mosquito study on the southern coast of James Bay (Jenkins and Knight 1952) nor was it represented among the few mosquitoes collected at various times around Rupert House, Quebec. Therefore, we were very surprised to find, during June 1977, large populations of larvae of *Ae. cantator* all along the saline part of the tidal zone of southwestern James Bay, from Boatswain Bay at the southern and north to Eastmain (52°15′N; 78°20′W). The larvae were extremely numerous, some populations containing as many as 75,000 larvae per cubic meter (L/m^3), and were the dominant species at that time.

The coast of James Bay is affected not only by the tide, but by the scouring action of the ice, which varies between 50 and 150 cm in thickness (Dionne 1976). In spring, blocks of ice forced on shore create numerous shallow depressions of different sizes. These depressions are filled with water from both the melting ice and the equinox tides. With the return of normal tide levels, the isolated pools become characteristic *Ae. cantator* breeding sites during the spring, supporting *Ae. dorsalis* and *Culiseta impatiens* (Walker) larvae later in the summer.

The upper section of the tidal zone, which contains these pools, is characterized by 2 parallel bands of vegetation: a lower level, with *Carex paleacea* and *C. salina* as the dominant species, and an upper level, characterized by the *Puccinellia lucida* and *Potentilla egedii* community. In the lower level, *Ae. cantator* was the only species of mosquito taken in the spring (mean larval density: 500 L/m^3) while in the second unit, it was the most abundant (70%), accompanied by *Ae. implicatus* Vockeroth. *Ae. punctor* (Kirby) was also taken, but only sporadically. The larval density in the pools of the upper level was considerably higher, varying from 10,000 to 75,000 L/m^3. In the summer, massive unmixed populations of *Ae. dorsalis* replaced the *cantator-implicatus* spring association.

In conclusion, we believe that the actual distribution of *Ae. cantator* is discontinuous, consisting of 2 littoral areas, the first along the Atlantic coast and the second along the eastern James Bay coast. Perhaps the actual distribution is continuous and we have only missed the connecting points of distribution. If, however, the 2 populations are truly separate, we can hypothesize 2 situations to explain the origin of the 2 separate populations of *Ae. cantator.* Firstly, colonizing females may have dispersed from the St. Lawrence River all the way to James Bay, a distance of nearly 500 miles. This species is noted for its long inland emigrations, and such a flight is not impossible. Secondly, the now discontinuous distribution may be a vestige of an earlier connection along a post-Pleistocene marine route between the Tyrrell Sea (former, a much larger version of Hudson and James Bay) and the Champlain Sea (Potter 1932, LaRocque 1949). We know that the Tyrrell Sea and the Champlain Sea were in close proximity, in what are now the region of the upper Ottawa River (or Lake Temiskaming) and the region of the Saguenay River. The existence during post-Pleistocene time of saline conditions so much farther west than at present could have allowed *Ae. cantator* relatively easy access to the interior and hence to the southern part of the Tyrrell Sea. The subsequent disappearance of suitable saline habitat in the Ottawa, western Lake St.-John and upper St. Lawrence Valleys would have eliminated *Ae. cantator* in the interior, leaving 2 residual populations, the first in James Bay and the second one in the Atlantic-side.

The second important conclusion of our study on the ecology of the littoral mosquito species around James Bay concerns the importance of the salinity as a factor in the distribution of the different species. First, we must say that the salinity decreases from the North of James Bay to

Rupert Bay, becoming negligible at Rupert House. According to Peck (1976), the salinity is around 23–24% at Pointe Louis XIV (the junction of Hudson Bay and James Bay), 20% at Fort-Georges, 10–15% at Eastmain and 8–10% in the middle of Rupert Bay. Consequently, the vegetal communities of the tidal zone of James Bay and Rupert Bay are markedly different; and so are the characteristic mosquito species inhabiting the 2 littoral types. For example, *Ae. dorsalis* and *Ae. cantator* were not found in the larval stage at Rupert Bay, where only *Ae. implicatus* was dominant in comparable tidal zone larval biotopes. As we already noted for Rupert Bay, only *Ae. cantator* inhabits the halophytic tidal vegetal communities and the farther one goes inland, the more *Ae. implicatus* replaces *Ae. cantator*. Therefore, this difference in salinity between the estuarine bays and the littoral *stricto sensu* of James Bay may explain why *Ae. cantator* had previously been overlooked. Jenkins and Knight who worked in 1952 around Moosonee and Moose Factory, which are estuarine zones, failed to find *Ae. cantator* there, probably because the salinity was too low. The eastern side of the Bay has been adequately explored for mosquitoes only around Rupert House, which is also located on a freshwater estuary. So, we suggest that both coasts of James Bay, including both fresh and brackish water habitats, be more thoroughly investigated. Such an investigation may well reveal the presence of *Ae. cantator* as far north as Attawapiskat (Ont.) and Fort-Georges (Que.) areas (the whole subarctic littoral zone).

ACKNOWLEDGMENTS. The authors wish to express grateful appreciation to D. M. Wood, Biosystematic Entomology, Ottawa, for confirming the identifications of the mosquitoes involved, and for assistance in preparing the manuscript.

References Cited

Bickley, W. E., Joseph, S. R., Mallack, J. and Berry, R. A. 1971. An annotated list of the mosquitoes of Maryland. Mosquito News 31(2):186–190.

Dionne, J. C. 1976. L'action glacielle dans les schorres du littoral de la Baie de James. Cahiers Géogr. Québec 20(50):303–326.

Evans, E. S. and McCuiston, L. J. 1971. Preliminary mosquito survey of the Wharton State Forest-Summer 1970. Proc. Fifty-eighth Annual Meeting of New Jersey Mosquito Exterm. Assn.: 118–125.

Gladney, W. J. and Turner, E. C. 1969. Insects of Virginia. No. 2. The mosquitoes of Virginia (Diptera: Culicidae). Virginia Polytech. Inst. Res. Div. Bull. 49. 24 pages.

Horsfall, W. R. 1955. Mosquitoes, their bionomics and relation to disease. Hafner Publ. Co., New York. (Reprinted by Arrangement 1972) 723 pages.

Jenkins, D. W. and Knight, K. L. 1952. Ecological survey of the mosquitoes of southern James Bay. The Amer. Midland Naturalist 47(2):456–468.

La Rocque, A. 1949. Post-Pleistocene connection between James Bay and the Gulf of Saint Lawrence. Bull. of the Geol. Soc. of America 60:363–380.

Main, A. J., Hayes, R. O. and Tonn, R. J. 1968. Seasonal abundance of mosquitoes southeastern Massachusetts. Mosquito News 28(4):619–626.

Peck, S. 1976. Nearshore oceanography of James Bay. Compte-rendu, Symposium 1976: Environnement-Baie James, Montréal. 115–146.

Potter, D. 1932. Botanical evidence for a post-Pleistocene marine connection between Hudson Bay and the St. Lawrence Basin. Rhodora 34:68–89, 101–112.

Saugstadt, E. S., Dalrymple, J. M. and Eldridge, B. F. 1972. Ecology of arboviruses in a Maryland freshwater swamp. I. Population dynamics and habitat distribution of potential mosquito vectors. Am. J. of Epidemiology 96(2):114–122.

Twinn, C. R. 1949. Mosquitoes and mosquito control in Canada. Mosquito News 9(2): 35–41.

Vockeroth, J. R. 1954. Notes on the identities and distributions of *Aedes* species of Northern Canada, with a key to the females (Diptera: Culicidae). Canad. Entomol. LXXXVI(6):241–255.