



Mosquitoes feeding on brushtail possums (*Trichosurus vulpecula*) and humans in a native forest fragment in the Auckland region of New Zealand

José G B Derraik, Weihong Ji, David Slaney

Abstract

A study was carried out to identify the native and exotic mosquito species that feed on possums (and also humans) during daytime in a native forest fragment in the Auckland region. Twenty-two possums were handled in spring 2005, and 21 in the following summer. A total of 32 female mosquitoes were collected while handling the possums (22 mosquitoes were on humans—all introduced *Aedes notoscriptus*; 10 on possums—9 *Ae. notoscriptus* and 1 native *Coquillettidia iracunda*). These results support previous findings that *Aedes notoscriptus* may regularly take blood meals from brushtail possums in New Zealand, as happens in Australia. Significant is the record of *Coquillettidia iracunda* feeding on a possum, which seems to be the first record of a native mosquito feeding on these animals in New Zealand. The potential public health implications of these findings are discussed.

To date there has not been a confirmed, indigenously acquired mosquito-borne virus infection in humans within New Zealand.¹ However, it seems that it is just a matter of time before an arboviral outbreak occurs.²⁻⁴ Ross River virus (RRV) is the most likely arbovirus to cause an outbreak in New Zealand, as it is the most common aetiologic agent of recognised arboviral disease in Australia.^{2,5}

Brushtail possums (*Trichosurus vulpecula* Kerr) are known competent hosts of RRV.^{6,7} Serological survey data confirmed that possums in Australia are commonly exposed to RRV in the field, where they are natural blood source for mosquitoes.^{7,8}

As a result, if an outbreak of RRV does occur in New Zealand, the virus could potentially become endemic due to the widespread and abundant presence of possums throughout the country.⁹ In Australia for instance, brushtail possums have been suggested to be responsible for maintaining RRV epidemics in urban areas, where they are likely to be a major vertebrate host for this virus in certain areas.^{7,8}

Very little is known about the feeding habits of native mosquitoes, but it seems that most species are primarily ornithophilic (bird-feeders) as a result of New Zealand's evolutionary history and the consequent absence of terrestrial mammals other than bats.⁹ An exception amongst native mosquitoes breeding in freshwater seems to be *Coquillettidia (Coquillettidia) iracunda* (Walker) as this species will aggressively bite humans.^{10,11}

In contrast to the native mosquitoes, invading mosquitoes tend to be opportunistic feeders and are usually anthropophilic (human feeders).¹²

This study aimed to identify the native and exotic mosquito species that feed on possums during daytime in a native forest fragment in the Auckland region. In addition, it is important to assess whether the same species that feed on possums also

feed on humans, as it could create suitable conditions for the transmission cycle of RRV if the mosquito happens to be a suitable vector.

Materials and Methods

The chosen field site was an indigenous forest fragment of approximately 12 hectares located at Coatesville reserve (36°42'S, 174°48'E), in the Auckland region, New Zealand. The site consists of mixed podocarp-broadleaf forest, lying within a heterogeneous rural landscape matrix, with the peripheral vegetation consisting of exotic pastures, orchards, pine plantations, and private gardens. Sampling was carried out in the daytime during spring (September 2005) and summer (February-March 2006).

Brush-tail possums are nocturnal animals and were trapped overnight. Each animal briefly anaesthetised using Isoflurane[®], so a series of measurements could be taken and data loggers placed on the animals as part of an ongoing research project.¹³

Adult mosquitoes were trapped (using a plastic container) while biting between 8:30 am and 1:00 pm. Each possum was handled for approximately 10 minutes, during which time mosquito sampling was carried out for approximately 4 minutes. During each procedure, sampling (i.e. collecting any mosquitoes on humans and possums) was also carried out for approximately 4 minutes on one of the two persons carrying out the procedure. All specimens collected were frozen and then placed in ethanol, for later identification.

Results and Discussion

A total of 22 possums were handled in spring 2005, but no mosquitoes were observed biting humans or possums. However, in the following summer, 21 possums were handled, during which time 32 female mosquitoes were collected while biting (Table 1); 22 of these mosquitoes were collected on humans, all being the introduced species *Aedes (Finlaya) notoscriptus* Skuse. Nine were *Ae. notoscriptus* mosquitoes collected on possums. The only other species recorded was one *Cq. iracunda* mosquito trapped while feeding on a possum (Table 1).

Table 1. Daytime collection of mosquitoes while biting humans and possums in Coatesville forest, Auckland region

Species	Season	Host	
		Human	Possum
<i>Coquillettidia iracunda</i>	Spring 2005	–	–
	Summer 2006	–	1
<i>Aedes notoscriptus</i>	Spring 2005	–	–
	Summer 2006	22	9

The absence of mosquitoes in the spring sampling was most likely a result of the lower than average rainfall and relatively mild temperatures. In the summer collection, although the number of mosquitoes recorded was relatively low, valuable information was obtained. Note that both *Ae. notoscriptus* and *Cq. iracunda* will seek hosts in the daytime within a forest environment.^{10,14} Therefore, the low abundance observed was a likely result of the climatic conditions at the time, in particular the extremely low rainfall recorded in the Northland/Auckland regions in the preceding weeks.¹⁵

Nonetheless, during this study *Ae. notoscriptus* was most often collected on humans, adding support to other studies indicating that it is anthropophilic.^{8,16} This exotic mosquito is the predominant peridomestic mosquito in its native Australia,¹⁷ and this pattern is being observed in many areas in northern New Zealand.⁹

Aedes notoscriptus is believed to be an important RRV vector in urban areas in Australia,¹⁸⁻²¹ and it could potentially play a similar role in New Zealand. Apart from being anthropophilic, the results obtained here support the evidence obtained by Bullians and Cowley,²² indicating that *Ae. notoscriptus* may regularly take blood meals from brushtail possums in New Zealand, as it happens in Australia.⁸

As previously pointed out, brushtail possums are likely to be an important vertebrate host for RRV in certain urban areas in Australia.^{7,8} Therefore, since *Ae. notoscriptus* is a RRV vector,⁸ these two Australian exotic species could possibly lead to endemic cycles of RRV in New Zealand, if the virus were to arrive here.

Significant is the record of the native *Cq. iracunda* feeding on a possum. Although only a single specimen was collected, this seems to be the first record of a native mosquito feeding on *T. vulpecula* in New Zealand. *Coquillettidia iracunda* is an aggressive biter that is readily attracted to humans and other animals such as dogs,¹⁰ and some populations of this species are known to produce high densities seasonally. *Coquillettidia iracunda* is closely related to a number of overseas disease vectors in the same subgenus (*Coquillettidia*), such as the Australian *Coquillettidia* (*Coquillettidia*) *linealis* (Skuse) that is a highly efficient laboratory vector of RRV, with this virus also having been isolated from this species in the field.²³ Therefore, *Cq. iracunda* could in theory pose a threat to public health as a potential arbovirus vector in New Zealand.

It should be noted however, that this work followed a window of opportunity. Sampling in other sites and during twilight and night-time hours would provide more comprehensive data on the range of species feeding on brushtail possums in New Zealand.

Competing interests: None.

Author information: José G B Derraik, Research Associate, Ecology and Health Research Group, Wellington School of Medicine and Health Sciences, University of Otago, Wellington; Weihong Ji, Ecology & Conservation Group, Institute of Natural Resources, Albany Campus, Massey University, Auckland; David Slaney, Institute of Environmental Science and Research Ltd, Porirua

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Correspondence: José G B Derraik, PO Box 2526, Wellington, New Zealand. Fax: (04) 894 0733; email: derraik@gmail.com

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