AN OUTBREAK OF ROSS RIVER VIRUS DISEASE IN THE SOUTH-WEST OF WESTERN AUSTRALIA

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Abstract

An outbreak of Ross River virus disease is occurring in the south-west of Western Australia. Over 500 serologically confirmed cases were reported from November 1995 to February 1996. The main regions affected by the mosquito-borne disease are communities on the Swan Coastal Plain south of Perth. Cases have also been reported from towns further south or inland and from Perth itself. We present a preliminary overview of the number of human cases, mosquito and virus activity and environmental conditions prior to and during the outbreak.

Introduction

The south-west of Western Australia has been the site of a number of outbreaks of Ross River virus (RRV) disease, most notably in 1988 / 89 and 1991 / 92[1,2]. A new outbreak occurred in the summer of 1995 / 96. While there are similarities between the outbreaks, there are some differences in the timing and location of virus activity in the current outbreak.

Methods

The University of Western Australia Department of Microbiology holds a database of cases of Ross River virus infection. The database has two sources of information. The first is notifications of Ross River virus infection reported to the Health Department of Western Australia by doctors under the State public health legislation. Where available these include case follow-up questionnaires carried out by Environmental Health Officers from relevant local authorities.

The database also includes reports of RRV infection from the Western Australian Centre for Pathology and Medical Research and a number of private pathology laboratories. These reports are cross-checked against the Health Department notifications. A small number of cases diagnosed by State and private laboratories, but not notified, are included in the database.

Monitoring of adult mosquito populations and RRV activity is carried out routinely by the University of Western Australia Department of Microbiology at up to 40 sites between Rockingham and Dunsborough (50-260 km south of Perth) each fortnight through spring and summer. In addition, saltmarsh mosquito breeding sites are regularly monitored by local authorities and Health Department personnel.

Results

The outbreak commenced in late 1995 and peaked in January 1996 (Figure 1). A total of 545 cases was reported between November 1995 and February 1996. Almost 65% of the cases reported to the end of February had dates of onset in January 1996.

The worst affected areas, in terms of total numbers of cases and case attack rates, were coastal towns and communities south of Perth. These include the area around the Leschenault Inlet (including the City of Bunbury) and the Shires of Capel and Busselton (Table 1). These regions are popular tourist destinations during the summer holidays.

A number of cases also occurred in Perth. Many of these were from semi-rural, outer-lying suburbs, but some were from suburbs closer to the city centre. Follow-up

Figure 1. Serologically confirmed cases of Ross River virus disease in the south-west of WA, by month of onset, July 1995 to February 1996

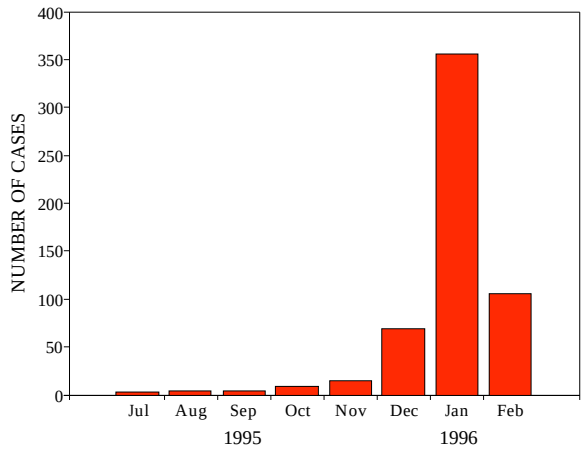

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Table 1. Cases of Ross River virus disease by month of onset and geographical region in the south-west of WA, July 1995 to February 1996[1]

Region	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Metropolitan area	1	1			6	23	99	17	147
Peel		1	3	1	1	8	34	9	57
Leschenault	2			1	3	9	114	30	159
Capel / Busselton				2	1	26	73	20	122
Inland / south coast		2		1	2	3	30	27	65
North / east of Perth			1	4	2		5	3	15
Total	3	4	4	9	15	69	355	106	565

1. Cases are recorded by most likely region of exposure where available (from case follow-up) or by region of residence otherwise. Data are incomplete.

information available to date shows that a considerable proportion of metropolitan cases were exposed in the south-west, particularly in the Leschenault, Capel and Busselton regions. However, there were also many cases from Perth that appear to have been locally acquired.

A substantial number of cases were reported from the Peel region, surrounding the Peel Inlet and Harvey Estuary.

Widespread breeding of *Aedes camptorhynchus* (larvae) was observed in the Capel-Busselton region in late October 1995. This prompted a media release by the Health Department, warning of an increased risk of transmission of RRV in the south-west. Unfortunately, almost no larval mosquito control was carried out in the worst-affected regions.

The adult mosquito monitoring program subsequently showed that extremely large populations of *Ae. camptorhynchus* survived through November and December (Figure 2). During the corresponding 1994 / 95 season, when almost no human cases were reported, far fewer mosquitoes were trapped (Figure 3). The number of mosquitoes collected per trap per night in the Capel-Busselton region during November and December 1995 (up to 10,000 mosquitoes per trap at some sites) is unprecedented in the five years of surveillance in the region. Similar results were obtained in the Leschenault region. These observations, along with the expected seasonal exodus of city dwellers to these areas during the Christmas holidays, prompted a second warning by the Heath Department in December 1995.

Fourteen isolates of RRV were obtained from *Ae. camptorhynchus* mosquitoes collected at a major wetland west of Busselton on 7 December 1995 (Figure 2). Large populations of potential vertebrate hosts (western grey kangaroos; *Macropus fuliginosus*) were also observed in close proximity to this site throughout spring and summer. Case follow-up indicates that a large percentage of Busselton cases were exposed in this locality. The last time that RRV was isolated from this site was during the 1991 / 92 outbreak in the region.

Table 2. Isolations of Ross River virus from mosquitoes collected in the Peel region, September 1995 to January 1996

Date	Species	Isolates of RRV
14.09.95	*Ae. camptorhynchus*	1
24.10.95	*Ae. camptorhynchus*	2
7.12.95	*Ae. camptorhynchus*	1
27.12.95	*Ae. camptorhynchus*	5
15.01.96	*Ae. camptorhynchus*	2
15.01.96	*Ae. vigilax*	3

Mosquito populations in the Capel-Busselton region and most areas of the Leschenault region decreased by mid January 1996. However, further human cases with dates of onset in February have been reported.

Several isolates of RRV were also obtained from mosquitoes collected in the Peel region, including some from *Aedes vigilax* (Table 2).

Analyses of environmental conditions prior to and during the outbreak are not yet complete. However, record high October daily rainfall was reported at numerous centres in the south-west. Above average rains occurred in November in Perth and in December in Mandurah, Bunbury and Capel-Busselton. These were accompanied by above average October and November temperatures at many south-west centres. A series of extremely high tides was also recorded along the Peel-Leschenault region coast around 20 December. This resulted from unusually early cyclonic activity along the north and west coasts of WA during December.

A small number of cases of Barmah Forest virus infection were diagnosed during the current outbreak. Numerous cases of a RRV-like illness were also reported, as was seen during the 1988 / 89 and 1991 / 92 outbreaks. Sera from these patients have been tested for IgM antibody to RRV and Barmah Forest virus but were negative for both.

Figure 2. Mean number of adult mosquitoes (total population and dominant species) and isolations of Ross River virus from mosquitoes at Capel-Busselton region wetland sites, January 1995 to January 1996

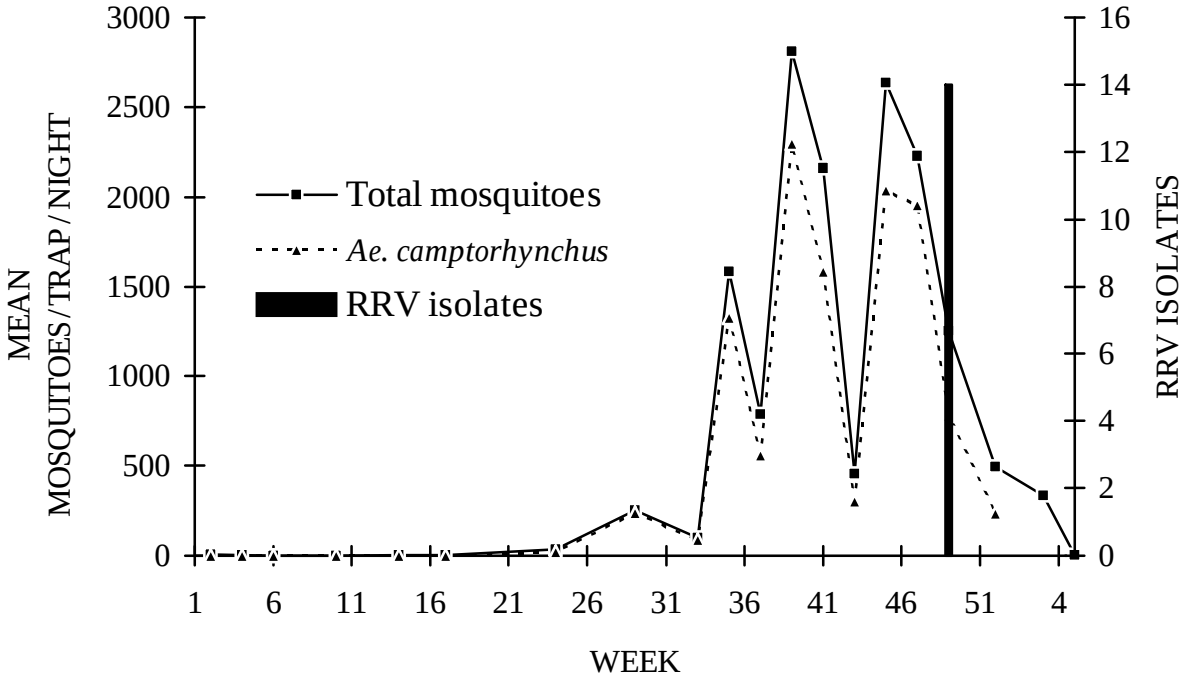
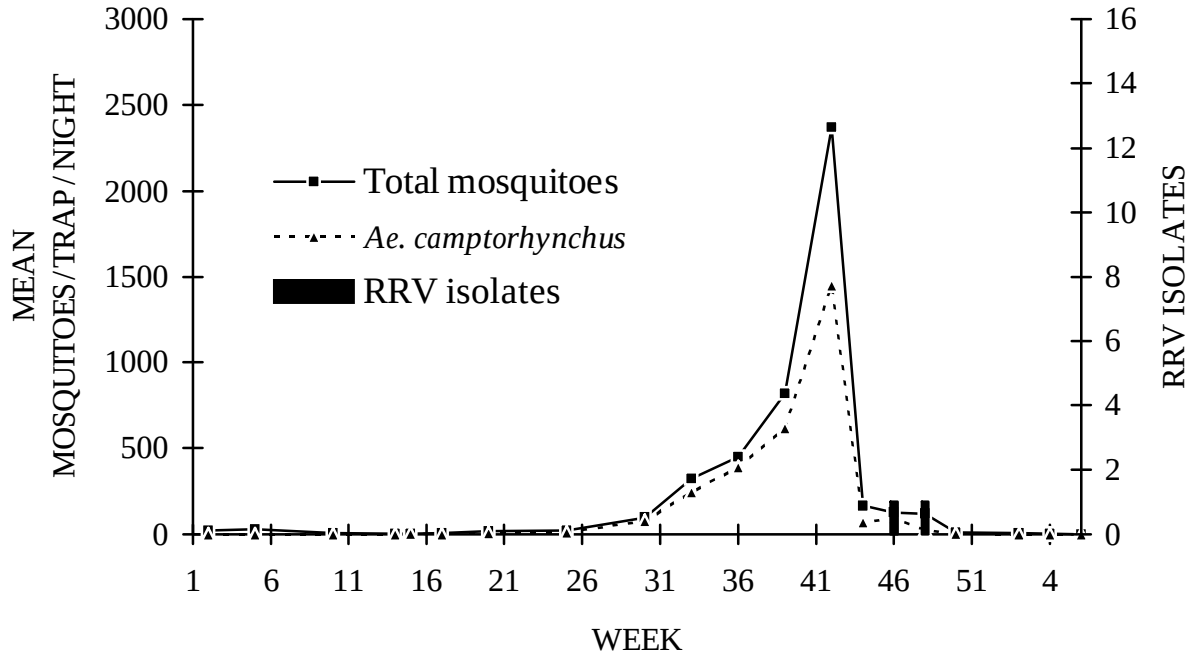


Figure 3. Mean number of adult mosquitoes (total population and dominant species) and isolations of Ross River virus from mosquitoes at Capel-Busselton region wetland sites, January 1994 to April 1995



Discussion

Monitoring of the incidence of human disease provided no indication of abnormally high levels of RRV activity in Western Australia until mid December 1995 when the number of reported cases began to rise sharply. In contrast, monitoring of mosquito breeding sites, adult mosquito populations and environmental conditions in late October and November 1995 showed there was potential for high levels of virus transmission.

This outbreak appears to have had a very rapid onset. However, further notifications and analysis of follow-up of cases for January and February may alter the epidemic curve. Previous south-west outbreaks also peaked in January or February but were considerably less acute. In addition, the number of notified cases is almost certainly an under-estimate of the true number of cases.

It appears that many holiday-makers from elsewhere in the south-west, as well as locals, were exposed to infected mosquitoes during the Christmas-New Year period. There are also many cases from Perth that appear to have been locally acquired. This was also the case during the two previously reported outbreaks.

The Peel region reported far fewer cases by late February than during the 1988/89 and 1991/92 outbreaks. During 1988 and 1991 virus activity in the Peel outbreaks commenced earlier than in the Leschenault and Capel-Busselton region. This is apparently not the case during the current outbreak. The reasons for these differences are not yet clear but it is of note that extensive control of saltmarsh mosquito breeding has been carried out in the Peel region this season.

Large saltmarshes and brackish wetlands in the Peel, Leschenault, Capel and Busselton regions provide an ideal breeding habitat for *Ae. camptorhynchus* mosquitoes[3,4]. This species is the major vector of RRV in the south-west of Western Australia. Surveillance during previous outbreaks has clearly shown that the risk of RRV transmission in coastal regions of the south-west increases markedly if large populations of adult *Ae. camptorhynchus* persist into late spring and summer[1,2].

The recent isolations of RRV from *Ae. vigilax* are of particular concern. This species is regarded as the major vector of RRV in coastal areas of northern and eastern Australia[5,6] but until now has had little or no role in transmission of RRV in the south-west[1,2]. *Ae. vigilax* has become the dominant species in the Peel region between December and March since the opening of the Dawesville Channel. It is a vicious biter, even during the day if weather conditions are suitable, and is known to disperse considerable distances from breeding sites. Thus, the potential for interaction between infected mosquitoes and humans in the Peel region may be greater and occur over a wider area than originally thought.

It is likely that a combination of environmental factors enabled widespread breeding and survival of vector mosquito species. Late spring and summer rains, a short-term rise in sea level (accompanied by higher tides) and mild spring and summer temperature conditions were predisposing factors during previous outbreaks in the south-west[1,2,6].

Preliminary analysis of the location of virus activity (measured as either human cases or isolations from mosquitoes) indicates that activity is far less likely in regions where virus activity was detected in the previous season. Thus, length of time since the previous outbreak may be a predisposing factor for higher levels of virus activity in the south-west. The reason for this is not yet known but may be due to higher levels of immunity in recently infected populations of enzootic or amplifying vertebrate hosts. This may help to explain the comparatively reduced numbers of cases in the Peel region this season following elevated levels of virus activity last year that coincided with the opening of the Dawesville Channel.

Some of the cases of RRV-like illness may represent individuals that had not seroconverted at the time of the first blood sample. However, many have since provided further samples, all of which have tested negative. Sera from these patients are currently being tested against a wide range of other Australian arboviruses and more samples will be sought to ensure that the phenomenon is not due to an extremely delayed immunological response to RRV.

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