An outbreak of Barmah Forest virus disease in Victoria

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Abstract

This report describes the epidemiological and clinical features of an outbreak of 47 cases of laboratory-confirmed Barmah Forest virus disease (BF disease) that occurred in Victoria between January and May 2002. Laboratory-confirmed cases were investigated, and information on travel history and clinical details was collected. Surveillance data from adult mosquito trappings and climatic conditions in the Wellington Shire were also reviewed. The response rate for interviews was 85 per cent (40/47). The most common symptoms reported by cases included arthralgia (95%), lethargy (90%) and maculopapular rash (72.5%). Transmission of BF disease in the Gippsland region was associated with unusually high numbers of *Ochlerotatus camptorhynchus* mosquitoes. This outbreak was of interest due to the fact that cases of BF disease outnumbered cases of Ross River virus disease (RR disease) in Victoria for the first time since data were available. Similar outbreaks of BF disease, in the absence of RR disease, occurred in Western Australia in 1993[1] and New South Wales in 1994/1995.[2] Although the majority of BF disease cases reported regular outdoor activity during which they could be exposed to mosquito populations, they infrequently take precautions to limit exposure. Further efforts need to be made to educate people of the importance of using repellents and other personal preventative measures. *Commun Dis Intell* 2002;26:600–604.

Keywords: Barmah Forest virus; surveillance; arbovirus; disease outbreak; Ochlerotatus camptorhynchus

Introduction

Barmah Forest virus (BF) is an alphavirus that was first isolated from mosquitoes trapped in the Barmah Forest of northern Victoria in 1974,[3] but was only shown to be pathogenic to humans since 1988.[4] BF is the causative agent of Barmah Forest virus disease (BF disease), which is similar to the epidemic polyarthritis caused by Ross River virus (RR).[5]

Since 1988, BF disease has been reported in Western Australia, Queensland, New South Wales, the Northern Territory and Victoria.[6] In Victoria, outbreaks have been previously reported throughout the Murray Valley and the Gippsland areas.[7]

The Communicable Diseases Section of the Victorian Department of Human Services noticed a greater than expected number of cases of BF disease in February 2002, and this prompted health warnings to be sent out to General Practitioners and media warnings for the Gippsland area, advocating preventative measures to residents and visitors.

This report describes epidemiological and clinical features of the outbreak based on a survey of laboratory-confirmed cases. Adult mosquito surveillance data were also analysed to determine whether there was an association between vector abundance and disease incidence.

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Methods

Ethical clearance was not required for this investigation as it was part of routine surveillance of a notifiable disease.

The following case definition was used for this outbreak.

> 'Isolation of BF from clinical material; or detection of BF by nucleic acid amplification; or a significant rise in IgG to BF; or detection of BF-specific IgM'

Using a standard questionnaire, we collected clinical details and travel histories from each laboratory-confirmed case that could be contacted. Information was also obtained from treating physicians.

To confirm the diagnosis made by the commercial laboratories, sera from the first 7 patients was retested at the Victorian Infectious Diseases Reference Laboratory. The diagnosis between both laboratories was consistent and the same testing methods were used in both (PanBio ELISA). All other notifications received were not retested and were included as confirmed cases.

Adult mosquito trapping data from six shire councils were obtained from the Victorian Department of Natural Resources and Environment. Adult mosquitoes were collected using carbon dioxide baited light traps and these were set once a week at Mildura (4 sites), Moira (4 sites), Shepparton (4 sites), Swan Hill (4 sites), Wellington (4 sites) and Wodonga Shires (4 sites).

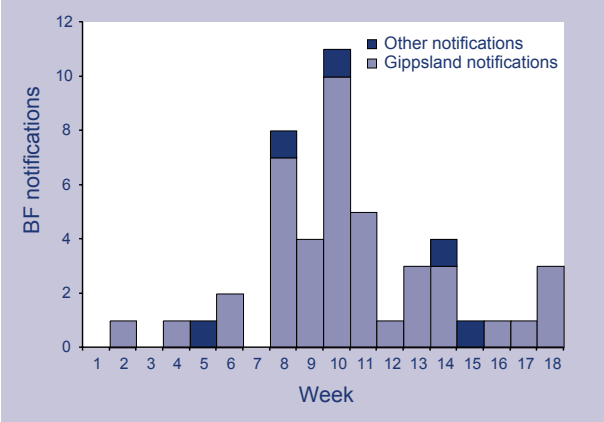
Mosquito trapping and counts have been carried out in four sites around Lake Wellington, Victoria, since 1991. Results are taken as representative of the Gippsland area (Wishart E, Department of Natural Resources and Environment, personal communication, May 2002). Trappings are seasonal and were carried out between 24 October 2001 and 8 April 2002.

Adult mosquitoes were identified to species and counted. Mosquito abundance was expressed as the mean number per trap. Rainfall data from each of the trapping sites and overall climate data for the Gippsland area were obtained from the Australian Bureau of Meteorology.

Results

Forty-seven cases of BF disease were notified to the Department of Human Services between 8 January and 1 May 2002 (Figure 1). Forty of the 47 patients were interviewed, a response rate of over 85 per cent. Cases consisted of 23 males and 24 females. Ages ranged from 17 to 74 years, with 51 per cent of cases aged between 20 and 49 years. One case was hospitalised.

Figure 1. Barmah Forest virus disease notifications, Victoria, January to May 2002, by notification date and link to Gippsland



* Week refers to the first 18 weeks of the year from 1 January 2002

Analysis of cases by patient's place of residence or travel history

Of the 47 cases, 38 lived in the Gippsland area; 34 within the East Gippsland Shire. Four cases resided in other regions of Victoria, but visited Gippsland between 10 January and 14 February 2002. Five cases had no link to Gippsland and were infected in other areas.

Clinical features

The most common symptoms experienced by cases included arthralgia, lethargy and maculopapular rash (Table 1).

Use of mosquito repellent and frequency of outdoor activities

A minority of cases (32.5% n=13) reported that they did use mosquito repellent regularly, with the remainder (67.5%, n=27) reporting no use, or occasional use. All cases that reported some use, said they applied repellent to all exposed areas of their body. Each case was questioned about extent of outdoor activity; 75 per cent participated in regular gardening (> 1/week), 25 per cent played golf at least once a week and 30 per cent went bushwalking (Table 2).

Table 1. Symptoms reported by cases (n=40)

Symptom	Number of patients	%
Arthralgia	38	95.0
Lethargy	36	90.0
Rash	29	72.5
Headaches	25	62.5
Myalgia	21	52.5
Fever	21	52.5
Chills	17	42.5

Table 2. Reported outdoor activity in interviewed cases (n=40)

Outdoor activity at least once/week	Number of patients	%
Gardening	30	75.0
Bushwalking	12	30.0
Golf	10	25.0
Camping	8	20.0
Fishing	7	17.5

Ross River virus disease

Over the same time period, there were only 21 notifications of RR disease in Victoria, eight of which were notified from the Gippsland area. There were 326 notifications for the same time period in 2001. Figure 2 shows the comparison of BF notifications and RR notifications over the first 5 months of 2002.

Mosquito counts

The main vector species of interest in the Gippsland area is *Ochlerotatus camptorhynchus*, and counts over the 2001/2002 season compared to the average count, can be seen in Figure 3. For the overall season, the trapping count for *Oc. camptorhynchus* was 1.4 fold greater than the 1991 to 2002 standardised trapping average. For the 2001/2002 season, 88 per cent of all mosquito species trapped were *Oc. camptorhynchus*.

The five other trapping sites in Victoria are inland sites and so the main species of interest is *Culex annulirostris*. Figure 4 shows the below average population of this mosquito species seen in the Mildura Shire during 2001/2002. A similar pattern of low seasonal abundance compared to the average was also seen in other trapping shires in Victoria (Wodonga, Shepparton, Moira, Swan Hill, data not shown).

Figure 2. Notifications of Barmah Forest virus disease and Ross River virus disease, Victoria, January to May 2002

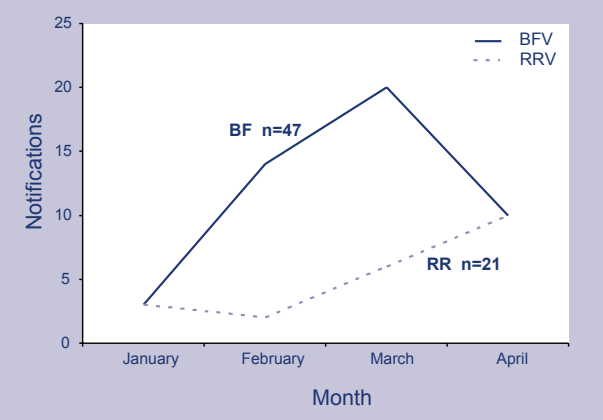
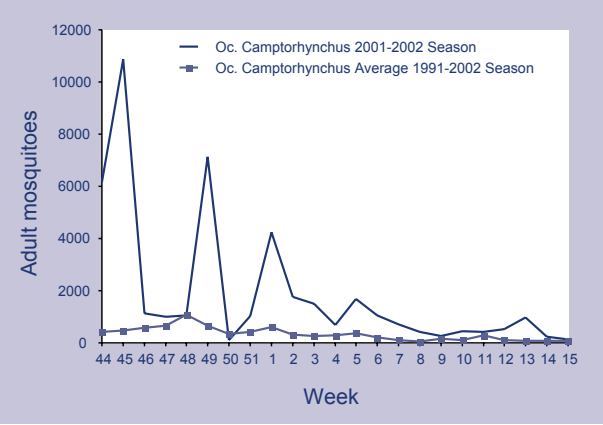


Figure 3. Mean weekly numbers of *Oc. camptorhynchus* per trap during the 2001/2002 season compared with overall mean for 1991/1992 to 2001/2002, Wellington Shire



Climate data

The Bureau of Meteorology data shows that the Gippsland area experienced a wetter than average spring to autumn months. Between October 2001 and March 2002, Gippsland received 1,046 mm of rainfall, with the average for these months being 746.75 mm, an increase of 40 per cent.

Rainfall data were also routinely collected from each mosquito trapping site and these figures were plotted against weekly mosquito counts. Figure 5 shows the relationship between rainfall and changes in mosquito density at the trapping sites in Wellington Shire.

Figure 4. Mean weekly numbers of *Cx. annulirostris* per trap during the 2001/2002 season compared with overall mean for 1992/1993 to 2000/2001, Mildura Shire

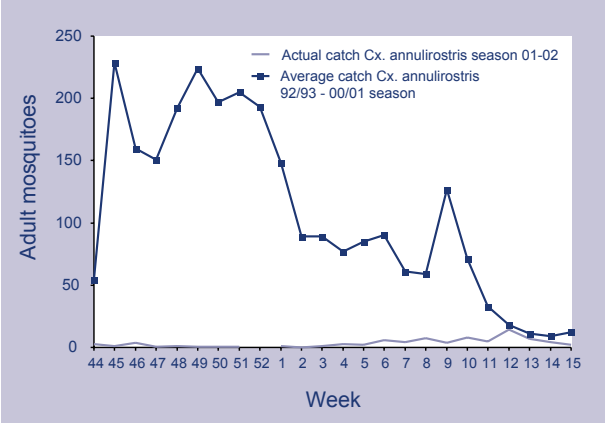
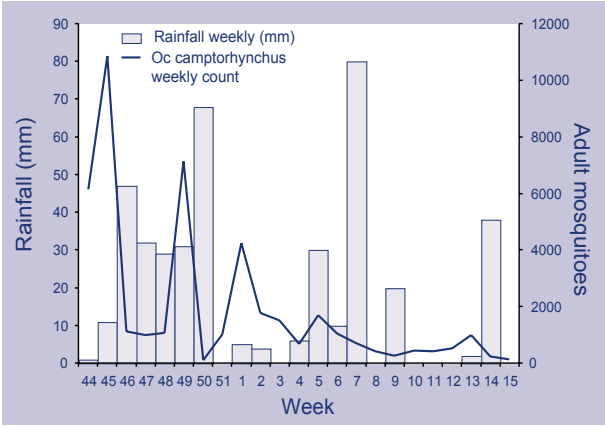


Figure 5. Relationship between mean weekly numbers of *Oc. camptorhynchus* per trap during the 2001/2002 season and weekly rainfall in Wellington Shire



Discussion

Between 1 January and 1 May 2002, 47 cases of BF disease were notified in Victoria. This figure is the highest number of cases in the first 5 months of the year since the RR and BF outbreak in the Loddon Mallee region of Victoria in 1993 (53 BF disease and 1,109 RR disease) (Notifiable Infectious Diseases Surveillance System Database. Communicable Diseases Section. Department of Human Services. Victoria, personal communication).

Comparisons against RR disease are of interest as this is the first time since data have been collected in Victoria, that BF notifications have outnumbered RR notifications. This same phenomenon has also been reported in the south-west of Western Australia in 1993[1] and in New South Wales in 1994-1995[2] and for the first 5 months of 2002 (Hogan D, New South Wales Health, personal communication, May 2002. and Communicable Disease Network Australia, National Notifiable Disease Surveillance System, personal communication, May 2002).

It is largely unknown why notifications of BF have been greater than RR, however the very dry summer experienced in the inland areas of Victoria appears to have greatly affected mosquito numbers, including the main vector species *Cx. annulirostris*. This in turn may have resulted in very little arbovirus amplification and transmission in the inland regions and therefore a reduction in the overall number of alphavirus notifications. This does not, however, explain the number of BF disease notifications from Gippsland or why very few RR disease notifications were received from this area. Gippsland experienced a wetter than average summer which resulted in an increase in the population of the salt marsh mosquito, *Oc. camptorhynchus*. As *Oc. camptorhynchus* is a vector for both BF[8] and RR,[9] one might expect to see a rise in BF notifications, but the low number of RR notification is not explained. However, it is interesting to note that the transmission of BF in the absence of RR has also been associated with large numbers of *Oc. camptorhynchus* in south-west Western Australia,[1] and with large numbers of *Oc. vigilax*, a closely related species from the same genus,

in New South Wales.[2] There is also laboratory evidence that RR transmission potential in *Oc. vigilax* may be reduced if the mosquitoes are exposed to high ambient temperatures.[10]

As theorised with previous outbreaks of BF in the absence of RR,[1] this incident may have been associated with lower immunity to BF compared to RR in both animal hosts and humans. Another possibility is that there was transmission of BF under conditions that were not conducive to the transmission of RR.[1]

Relatively little is known about BF disease and its animal reservoirs. This lack of knowledge affects the management of this disease, and at present there is little that can be done other than reducing vector mosquito populations and educating the public on preventing exposure. When cases were being interviewed, some commented that exposure to mosquitoes was high. Despite this, information gathered from this outbreak suggests that residents infrequently take precautions to limit exposure to mosquitoes, and population complacency is a potential factor that may need to be addressed.

BF disease is a disease where prevention is critical in reducing the risk of being infected, and further efforts need to be made to educate people of the importance of using repellents that are effective against mosquitoes and taking other personal preventative measures. Further research is needed to determine what other methods could be employed to control this disease.

References

1. Lindsay, MDA, Johansen, CA, Smith, DW, Wallace, MJ, Mackenzie, JS. An outbreak of Barmah Forest virus disease in the south-west of Western Australia. *Med J Aust* 1995;162:291–294.
2. Doggett S, Russell R, Cloonan M, Clancy J, Haniotis J. Arbovirus and mosquito activity on the south coast of New South Wales, 1994–1995. *Commun Dis Intell* 1995;19:473–475.
3. Marshall ID, Woodroofe GM, Hirsch S. Viruses recovered from mosquitoes and wildlife serum collected in the Murray Valley of south-eastern Australia, February 1974, during an epidemic of encephalitis. *Aust J Exp Biol Med Sci* 1982;60: 457–470.
4. Phillips D. Barmah Forest virus infection in Queensland, 1988–1989. *Commun Dis Intell* 1989;15:6–7.
5. Arthropod-borne viral arthritis and rash. In: Chin J ed. *Control of Communicable Diseases Manual* 17th ed. Washington: American Public Health Association, 2000:37–39.
6. Mackenzie JS, Broom AK, Hall RA, Johansen CA, Lindsay MD, Phillips DA, *et al*. Arboviruses in the Australian region, 1990 to 1998. *Commun Dis Intell* 1998;22:93–100.
7. Norris PM, Robinson P. Barmah Forest virus disease in Gippsland, Victoria. *Commun Dis Intell* 1995;19:373–375.
8. Aldred J, Campbell J, Davis G, Lehmann N, Wolstenholme J. Barmah Forest virus in Gippsland Lakes region, Victoria. *Med J Aust* 1990;153:434.
9. Campbell J, Aldred J, Davis G. Isolation of Ross River virus from *Aedes camptorhynchus*. *Med J Aust* 1989;150:602–604.
10. Kay BH, Jennings CD. Enhancement or modulation of the vector competence of *Ochlerotatus vigilax* for Ross River virus by temperature. *J Med Entomol* 2002;39:99–105.