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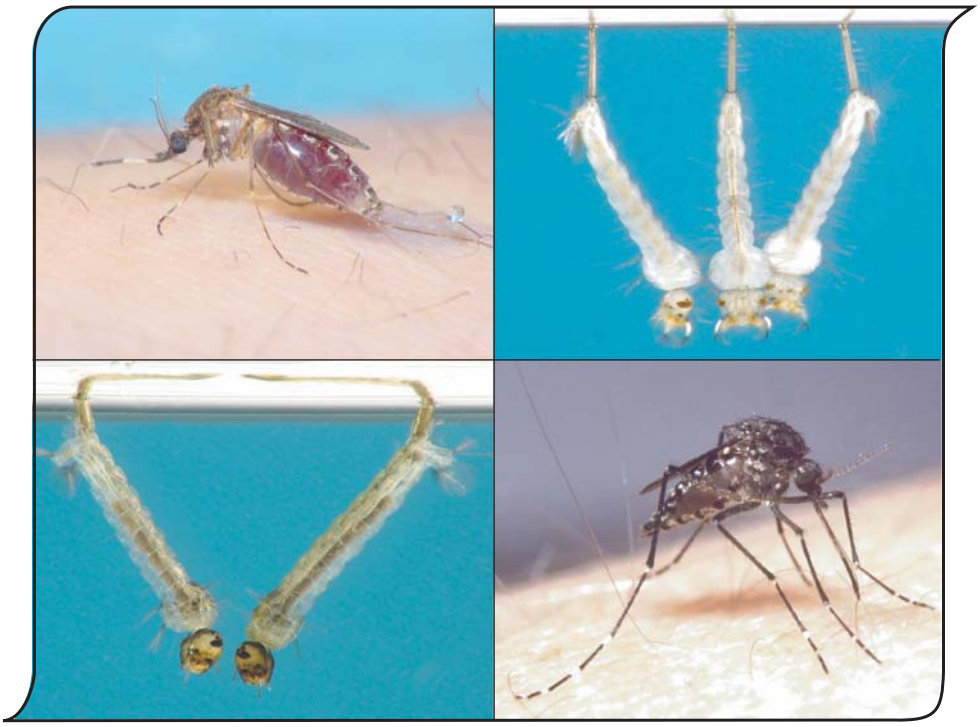
THE NEW SOUTH WALES ARBOVIRUS SURVEILLANCE & MOSQUITO MONITORING PROGRAM

2002 - 2003 Annual Report



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Authorised by

ARBOVIRUS DISEASE CONTROL ADVISORY GROUP, NSW HEALTH.

NSW HEALTH

EXECUTIVE OVERVIEW

- For the 2002-2003 season, the NSW Arbovirus Surveillance Program: (i) Monitored mosquito vector populations and undertook surveillance of arbovirus activity on the NSW western slopes and plains, far north coast region, south coast and metropolitan Sydney. (ii) Monitored flavivirus transmission through the testing of sentinel chickens across inland NSW. The majority of sites operated between November and April.

- Rainfall levels for the second half of 2002 were among the lowest on record. For the early months of 2003 across the inland region, precipitation patterns remained below average to normal. These dry conditions ensured that mosquito numbers were well below average across the inland for the entire season.

- With the low mosquito numbers, there was minimal virus activity, with only 8 isolates (all unknowns) from mosquitoes collected inland. There were no seroconversions in the sentinel chickens. As a result of the low mosquito/arbovirus activity, the total number of human notifications from inland regions was one of the lowest since reporting began.

- Neither the Forbes' or Nicholls' models are suggesting probable MVE activity for the 2003-2004 season.

- Only five coastal locations undertook trapping this year. Coastal rainfall patterns were below average in early summer and mosquito numbers were generally down. Heavy rainfall from February through to April in the far north of the state resulted in an explosion of mosquito numbers, with populations remaining high well into May. The freshwater mosquitoes, notably *Ochlerotatus multiplex* and *Ochlerotatus procax*, dominated these collections.

- This season saw the largest epidemic of Barmah Forest virus disease in Australia to date, with the majority of notifications occurring within the Northern Rivers AHS (213 cases). Combined with the Mid-North Coast, which also had extensive activity, there were a total of 350 cases between July 2002 and June 2003 from the north coast. This outbreak follows upon large epidemics of Barmah Forest virus in the same region over the previous two seasons and highlights the need for further research into the ecology of this emerging disease. Concomitant with the Barmah Forest virus activity, was an epidemic of Ross River virus disease in the same Area Health Services, with some 347 human cases.

- For the Sydney trapping locations, there were some large collections of the saltmarsh mosquito *Ochlerotatus vigilax* from the sites near to Homebush Bay. For the freshwater species, mosquito numbers were well down. There were every few human notifications from within the region.

- The NSW Arbovirus Surveillance Web Site http://www.arbovirus.health.nsw.gov.au/ continues to expand and now has over 139MB of information with 870 pages, and receives around 25,000 hits/month.

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NSW ARBOVIRUS SURVEILLANCE AND MOSQUITO MONITORING PROGRAM 2002-2003

INTRODUCTION

The aim of the Program is to provide an early warning of the presence of Murray Valley Encephalitis virus (MVEV) and Kunjin virus (KUNV) in the state in an effort to reduce the potential for human disease. In addition, it compiles and analyses mosquito and alphavirus (especially Ross River (RRV) and Barmah Forest (BFV) viruses) data collected over a number of successive years. This will provide a solid base to determine the underlying causes of the seasonal fluctuations in arbovirus activity and the relative abundance of the mosquito vector species with the potential to affect the well being of human communities. This information can then be used as a basis for modifying existing local and regional vector control programs, and in the creation of new ones.

METHODS

Background

Arbovirus activity within NSW can be divided into two broad biogeographical regions; the inland and the coastal strip. Within these areas are different climatic influences, different mosquito vectors, different viral reservoir hosts and even different mosquito borne viruses. As a consequence, the epidemiology of disease patterns is often vastly different and thus the surveillance program is tailored around these variables.

Arbovirus Surveillance can be divided into two categories: those methods that attempt to predict activity and those that demonstrate viral transmission. Predictive methods include the monitoring of weather patterns, the long-term recording of mosquito abundance, and the isolation of virus from vectors. Monitoring of rainfall patterns, be it short term with rainfall or longer term with the Southern Oscillation, is critical as rainfall is one of the major environmental factors that influences mosquito abundance; generally the more rain, the higher the mosquito numbers. The long-term recording of mosquito abundance can establish baseline mosquito levels for a location (i.e. determine what are normal populations), and this allows the rapid recognition of unusual mosquito activity. The isolation of virus from mosquito vectors can provide the first indication of which arboviruses are circulating in an area. This may lead to the early recognition of outbreaks and be a sign of the potential disease risks to the community. Virus isolation can also identify new viral incursions, lead to the recognition of new virus genotypes and identify new vectors. Information from vector monitoring can also reinforce and strengthen health warnings of potential arbovirus activity.

Methods that demonstrate arboviral transmission include the monitoring of suitable sentinel animals (such as chickens) for the presence of antibodies to particular viruses (e.g. MVEV and KUNV within NSW) and the recording of human cases of disease. Sentinel animals can be placed into potential ‘hotspots’ of virus activity, and as they are not protected from mosquito bites, may indicate activity in a region before human cases. In general terms, for arbovirus surveillance within NSW, the monitoring of human cases

has little direct value, as by the time the virus activity is detected in the human population, often not much can be done to control the virus. Via the other methodologies, the aim of the surveillance program is to recognise both potential and actual virus activity before it impacts greatly on the human population. The recording of human infections does however provide important epidemiological data and can define the locations where surveillance should occur.

These methods of surveillance are listed in order; generally with more rainfall comes more mosquito production. The higher the mosquito production, the greater the probability of enzootic virus activity in the mosquito/host population. The higher the proportion of virus infected hosts and mosquitoes, the greater the probability of transmission and thus the higher the risk to the human population. The NSW Arbovirus Surveillance and Mosquito Monitoring Program undertakes the first four methods of arbovirus surveillance and the results for the 2002-2003 season follow.

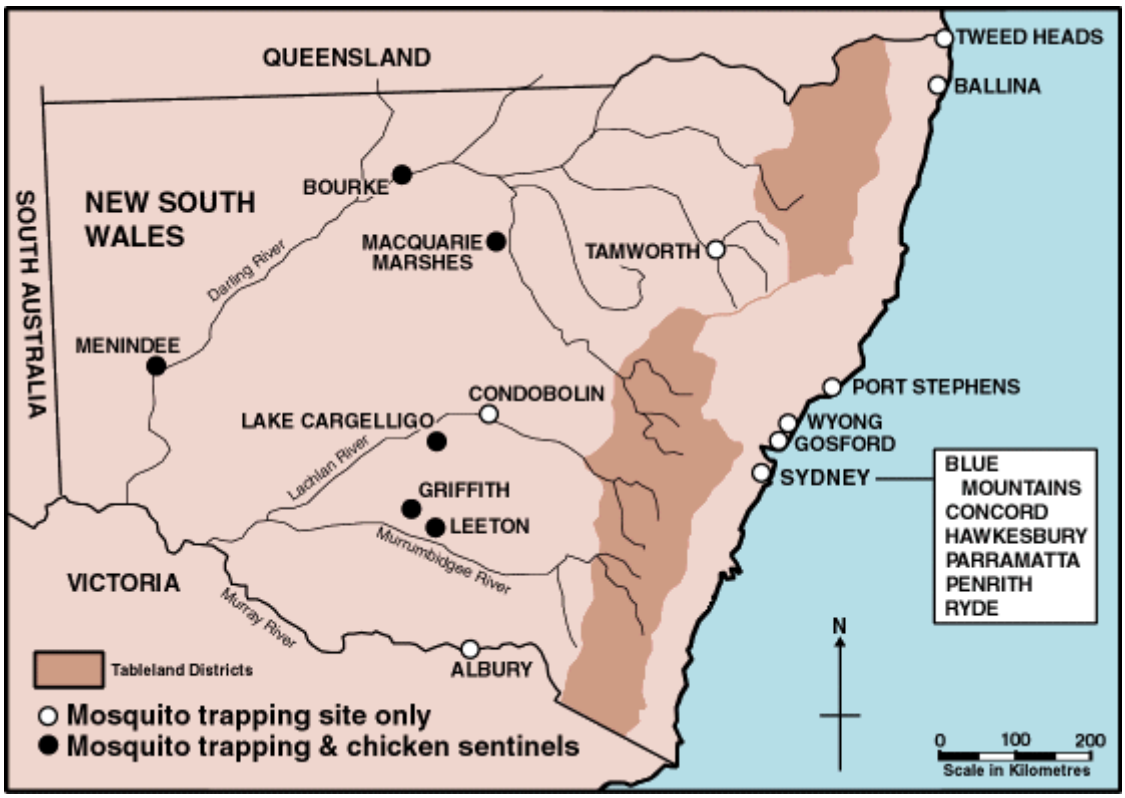


Fig 1. Mosquito trapping locations and Sentinel Chicken sites, 2002-2003.

MONITORING LOCATIONS

http://www.arbovirus.health.nsw.gov.au/areas/arbovirus/location/locations.htm

For 2002-2003, mosquito-trapping sites were operated at 9 inland, 5 coastal and 6 Sydney locations (Fig 1). Chicken sentinel flocks were located at 6 sites.

WEATHER DATA

http://www.arbovirus.health.nsw.gov.au/areas/arbovirus/climate/climate.htm

Mosquito abundance is dictated principally by rainfall patterns and irrigation practices in inland regions, while in coastal regions tidal inundation along with rainfall is important. Temperature and/or day-length are often critical in determining the initiation and duration of mosquito activity for species in temperate zones. Hence, the monitoring of environmental parameters, especially rainfall, is a crucial component of the Program.

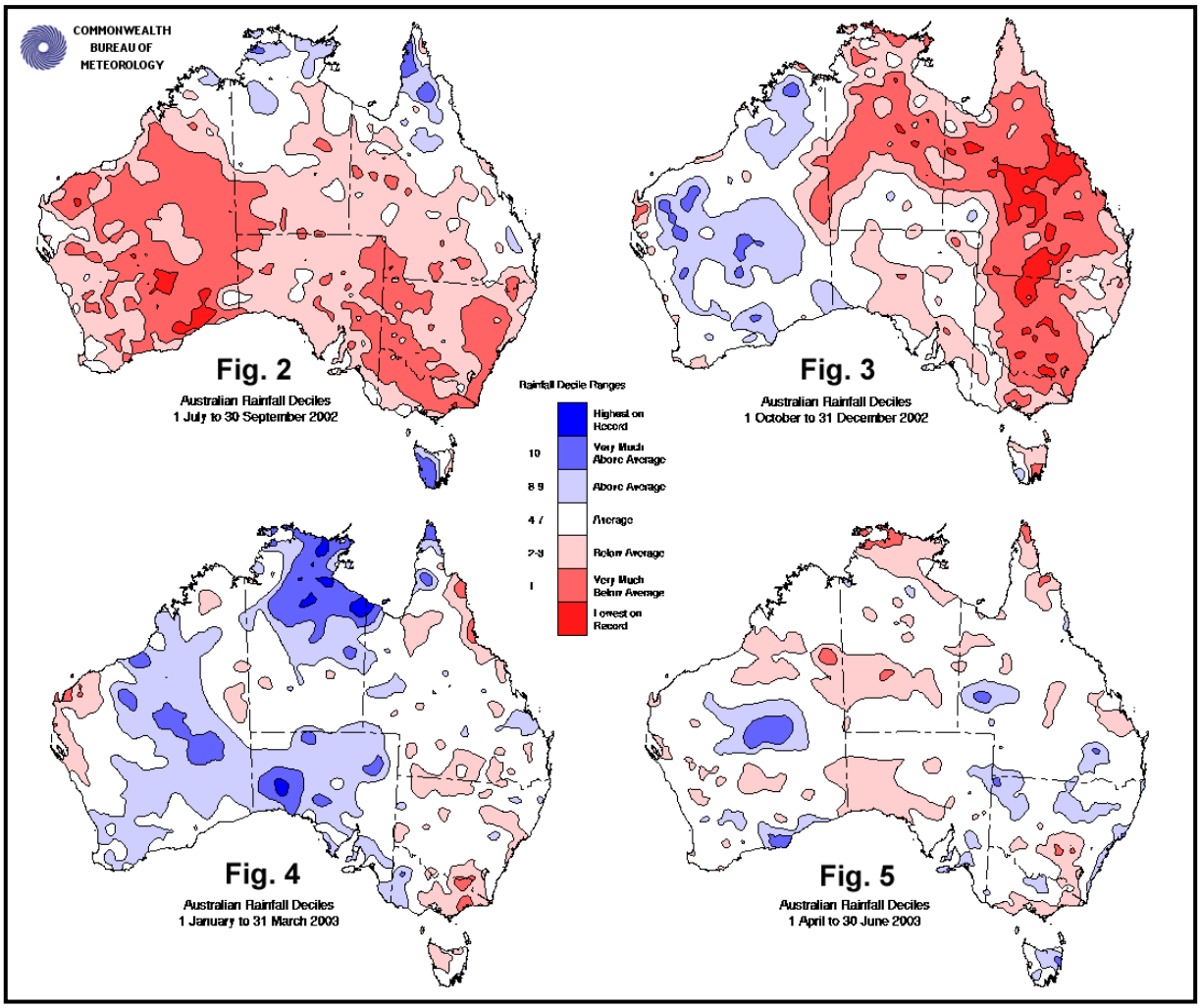


Figure 2-5. Australian Rainfall deciles for the 3 month periods, Jul-Sep 2002, Oct-Dec 2002, Jan-Mar 2003 & Apr-Jun 2003. The stronger the red, the drier the conditions. The stronger the blue, the wetter the conditions. *Modifed from the Australian Bureau of Meterology, 2003*.

The dry conditions, which prevailed through the 'mosquito season' of 2001-2002 continued for the remainder of the year 2002. The six-month period from July to December (Figures 2 & 3) had some of the driest conditions ever recorded for eastern Australia. Many areas of NSW received the lowest ever recorded rainfall figures, with much of the state being declared as in drought status (i.e. in a 'severe rainfall deficiency'). These conditions were barely alleviated during summer, as rainfall for the following three months (January to March) was average to slightly below average (Figure 4). Similar conditions have prevailed through Autumn and early Winter of 2003 (Figure 5), although some areas of the northern inland and south coast had above

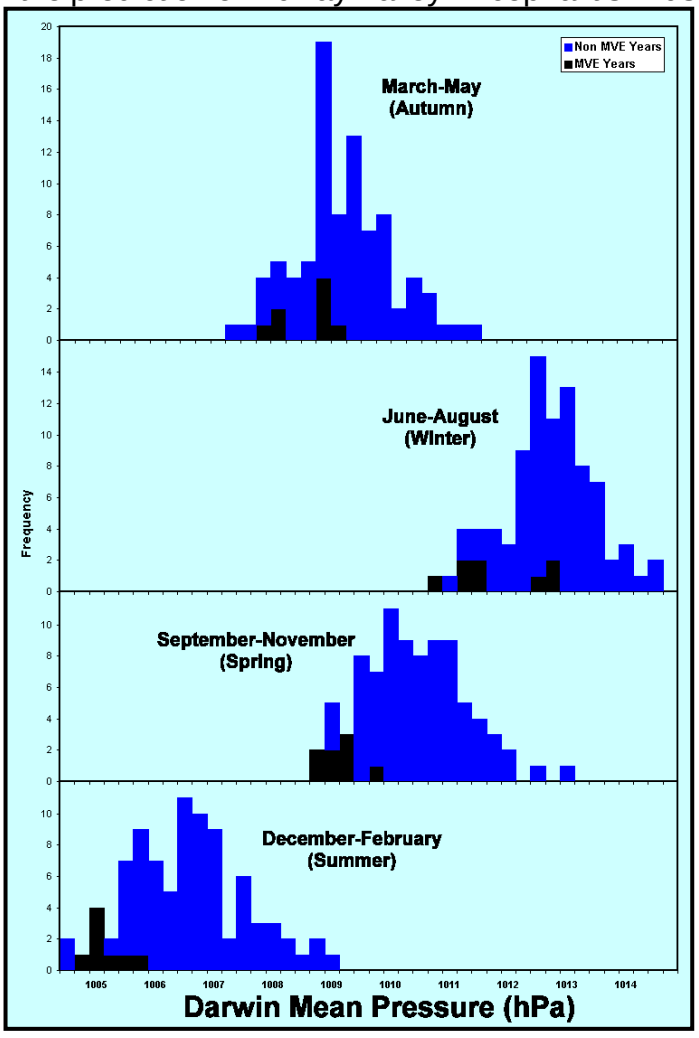
average rainfall.

The only notable exception to the above dry conditions was some heavy rainfall experienced along the north coast during the last week of February, in mid-March and late April. During these months, Ballina received around twice the normal level of rainfall, with the heavy mid-March rainfall coinciding with the spring tides.

With the dry conditions, came warmer weather and temperatures were well above average from April 2002 to the end of the January 2003. More normal temperatures prevailed until the end of the mosquito season.

MVEV Predictive Models

Two models have been developed for the prediction of Murray Valley Encephalitis virus (MVEV) activity in eastern Australia; the Forbes' (1978) and Nicholls' (1986) models.



Forbes associated rainfall patterns with the 1974 and previous MVEV outbreaks, and discussed rainfall in terms of 'decile' values. A decile is a ranking based on historical values. The lowest 10% of all rainfall values constitute decile 1, the next 10% make up decile 2, and so on up to the highest 10% of rainfall constituting decile 10. Thus, the higher the decile value, the greater the rainfall.

Forbes' hypothesis refers to rainfall levels in the catchment basins of the main river systems of eastern Australia. These include:

- The Darling River system,
- The Lachlan/ Murrumbidgee/ Murray River systems,
- The Northern Rivers (that lead to the Gulf of Carpentaria), and
- The North Lake Eyre system.

The hypothesis states that if rainfall levels in these four catchment basins are equal to or greater than decile 7 for either the last quarter of the previous year (eg. October- December 2001) or the first quarter of the current year (January-March 2002) and the last quarter of the current year (October-December 2002), then a MVEV outbreak is probable.

Rainfall was not above decile 7 for all the catchment basins for the last quarter of 2001,

the first quarter of 2002 or the last quarter of 2002. Thus, Forbes' hypothesis was not satisfied for the 2002-2003 season.

Nicholls' hypothesis uses the Southern Oscillation (SO) as a tool to indicate possible MVEV activity. He noted a correlation between past outbreaks of MVEV and the SO (as measured by atmospheric pressures at Darwin in mm) for the autumn, winter and spring period prior to a disease outbreak. For the autumn, winter and spring periods of 2002, the SO values of 1010.23mm, 1013.80mm and 1011.30mm respectively, were all outside the range of values for the same period of past MVEV active years. Likewise, the summer 2002–2003 SO value of 1007.50mm was also much higher than that experienced during MVE active years. Currently, the autumn and winter values according to Nicholls' for 2003 are 1010.13mm and 1013.10mm, respectively. These are outside the range of values for past MVEV years.

MOSQUITO MONITORING

Methods

Mosquitoes were collected overnight in dry-ice baited EVS type traps. They were then sent live in cool, humid eskies via overnight couriers to the Department of Medical Entomology at Westmead Hospital for identification and processing for arbovirus isolation. The mosquitoes were identified via taxonomic keys and illustrations according to Russell (1993, 1996), Dobrotworsky (1965) and Lee *et al*. (1980 – 1989).

Mosquito abundances are best described in relative terms, and in keeping with the terminology from previous reports, mosquito numbers are depicted as:

- 'low' (<50 per trap),
- 'moderate' (50-100 per trap),
- 'high' (101-1,000 per trap),
- 'very high' (>1,000 per trap), and
- 'extreme' (>10,000 per trap).

All mosquito monitoring results (with comments on the collections) were placed on the NSW Arbovirus Surveillance Web site, and generally were available within 1-2 days of receiving the sample into the laboratory. Access to each location's result is from: **http://www.arbovirus.health.nsw.gov.au/areas/arbovirus/results/results.htm**.

Results

Overall, 103,141 mosquitoes representing 43 species were collected in NSW during the 2002-2003 season. *Culex annulirostris* and *Anopheles annulipes* were the most abundant and most important of the inland mosquito species during the summer months. *Ochlerotatus vigilax*, *Coquillettidia linealis*, *Verrallina funerea*, *Ochlerotatus multiplex* and *Culex annulirostris* were the most numerous species on the coast.

Inland

Mosquito populations across the inland where well down with the drought conditions. In fact, this season recorded the lowest numbers ever during the history of the Arbovirus

Surveillance Program. Mosquito numbers were down by around 25% upon the previous season, which was also an unusually dry year. Populations were especially low and well below average through to mid-February. While some sites recorded 'very high' collections of over 1,000 mosquitoes, even these were often well below the long term average. A total of 30,941 mosquitoes, comprising 12 species was collected from inland NSW. *Culex annulirostris* was the dominant species trapped at most sites and generally comprised from 60-90% of the collections. *Anopheles annulipes* was the next most common species.

Coastal

Only five locations undertook trapping from the coast. Rainfall patterns along the coast were drier than normal for much of spring and early summer. As a result, mosquito numbers were mostly average to below average, although several sites had some large collections early in the season. Heavy rainfall through February to April, especially in the far north of the state, encouraged mosquito breeding with large mosquito numbers ensuing, being well above average. These large collections, coupled with some mild weather patterns meant that the mosquito season extended well beyond the norm for the northern sites. In total, 56,574 mosquitoes comprising 41 species were collected from coastal NSW. The most common species collected were *Ochlerotatus vigilax*, *Coquillettidia linealis*, *Ochlerotatus multiplex*, *Verrallina funerea*, *Ochlerotatus procax* and *Culex annulirostris*.

Metropolitan Sydney

Mosquito collections from Sydney generally remained relatively low with the dry conditions. The increase in overall numbers trapped this season compared to the last (15,626 *c.f.* 9,863) was mainly due to large collections of *Ochlerotatus vigilax* trapped at Parramatta. A total of 15,626 mosquitoes, comprising 24 species, was collected from metropolitan Sydney. With the dry conditions, the species composition was strongly dominated by the saltmarsh mosquito, *Ochlerotatus vigilax*, and the freshwater breeders were noticeably fewer in number this season.

A brief summary of the surveillance for each location follows the Sentinel Chicken Flock section. Note that complete mosquito monitoring results are available on the NSW Arbovirus Surveillance web site.

ARBOVIRUS ISOLATIONS FROM MOSQUITOES

http://www.arbovirus.health.nsw.gov.au/areas/arbovirus/about/methods.htm

Methods

Only mosquitoes collected from the inland and some Sydney sites were processed for viruses. Viral isolation methods were as per earlier annual reports (Doggett *et al*., 1999a, 2000). Assays were used to identify any suspected viral isolate, and can identify the alphaviruses - Barmah Forest (BFV), Ross River (RRV) and Sindbis (SINV), and the flaviviruses - MVEV, Kunjin (KUNV), Alfuy (ALFV), Edge Hill (EHV), Kokobera (KOKV) and Stratford (STRV). Any isolate that was not identified by the assays was labelled as 'unknown'.

Positive results were sent to Dr Jeremy McAnulty of the AIDS and Infectious Disease Branch, NSW Health, and to the relevant Public Health Unit, and posted on the NSW Arbovirus Surveillance Web Site (under 'Mosquito/Chicken Results') and under each location.

Results

http://www.arbovirus.health.nsw.gov.au/areas/arbovirus/results/virusisolates.htm

Of the mosquitoes processed, there were 8 viral isolates. These are listed in Table 1.

Table 1. Arbovirus Isolates, 2002-2003.

LOCATION - Site	Date Trapped	Mosquito Species	Virus ?
GRIFFITH - Hanwood	17/2/2003	*Anopheles annulipes*	**1**
GRIFFITH - Willbriggie	17/2/2003	*Anopheles annulipes*	**1**
GRIFFITH - Hanwood	24/2/2003	*Culex annulirostris*	**1**
GRIFFITH - Willbriggie	3/3/2003	*Culex annulirostris*	**1**
GRIFFITH - Hanwood	3/3/2003	*Culex annulirostris*	**1**
LEETON – Farm 347	10/3/2003	*Anopheles annulipes*	**1**
LEETON – Farm 347	17/3/2003	*Anopheles annulipes*	**2**
TOTAL			**8**

Virus ? = unknown (not MVEV, KUNV, EHV, STRV, KOKV, RRV, BFV or SINV)

SENTINEL CHICKEN PROGRAM

http://www.arbovirus.health.nsw.gov.au/areas/arbovirus/about/chickenmethods.htm

Sentinel chicken flocks of 15 birds were deployed at six locations this season including Bourke, Griffith, Lake Cargelligo, Leeton, Macquarie Marshes and Menindee. Testing was conducted from mid-November through to mid-April. The birds were bled weekly and tested for the presence of flavivirus antibody. Regular reports were emailed to the public health units and included on the NSW Arbovirus Surveillance web site.

There were no seroconversions detected in the flocks this season.

LOCATION-BY-LOCATION SUMMARY

Inland Locations

Albury: collections were well below average throughout the entire trapping season and never rose above 'low' numbers. No viruses were isolated.

Bourke: mosquito numbers were 'low' up until mid February, with one 'high' collection in late February, dominated by *Culex annulirostris*. Generally, mosquito numbers failed to rise substantially. There were no viral isolates or any flavivirus seroconversions in the sentinel chickens.

Condobolin: trapping was irregular and conducted only over three weeks. Mosquito collections were continually well below normal and never were above 'medium' in number. No viruses were isolated.

Deniliquin: no mosquito collections were made or sentinel chickens operated this year.

Forbes: no mosquito collections were made or sentinel chickens operated this year.

Griffith: mosquito numbers were well below average through the entire season and it wasn't until mid-February before the first 'very high' collection was made. Some 'very high' numbers were collected during February, but only from Willbriggie and these numbers were again well below the long term average. Mosquito numbers from Hanwood failed to rise dramatically and the first 'high' collection wasn't made until mid-January. There were 5 unknown viral isolates. No flavivirus seroconversions occurred in the sentinel chickens.

Lake Cargelligo: despite some fifteen weeks of trapping, not one mosquito was trapped and thus there were no viral isolates. There were no flavivirus seroconversions in the sentinel chickens.

Leeton: the highest numbers from any trapping location this season were yielded from Leeton. Farm 347, trapped 'very high' numbers almost continuously from mid-January through to late March and were thereafter 'high' until the end of the season. Numbers did not reach the same levels at Almond Rd, although were 'high' from early January until April. There were 3 unknown isolates, all from Farm 347. No flavivirus seroconversions occurred in the sentinel chickens.

Macquarie Marshes: trapping occurred on only three occasions and numbers were always 'low'. There were no viral isolates from the mosquitoes. No flavivirus seroconversions occurred in the sentinel chickens.

Menindee: no mosquito trapping was undertaken this year. There were no flavivirus seroconversions in the sentinel chickens.

Tamworth: trapping was conducted only over two weeks and numbers were 'low'. There were no viruses isolated from the mosquitoes.

Wanaaring: no mosquito collections were made or sentinel chickens operated this year.

Wee Waa: no mosquito collections were made or sentinel chickens operated this year.

Coastal Locations

Ballina: mosquito numbers were well below average and 'low' up until early March from Greenfield Road. Numbers then notably increased and were 'high' for the remainder of the season, even into May. North Creek Road showed a similar trend, although it yielded many more mosquitoes. Collections at this site were 'medium' to 'high' in the first month of trapping and then declined and were mostly 'low' to 'medium' and below average up

until February. Mosquito numbers went through a rapid increase and reached 'very high' densities in mid-March, being over three times the average. Numbers remained 'high' for the remainder of the trapping period into mid-May. Collections were dominated by freshwater species at Greenfield Road, including *Ochlerotatus multiplex* and *Oc. procax*, while at North Creek Road the predominate species were *Verrallina funerea*, *Culex sitiens* and *Ochlerotatus multiplex*. No virus isolation was undertaken.

Batemans Bay: no mosquito collections were made this year.

Gosford: mosquito collections were quite variable throughout the season, largely due to fluctuations in the dominant species, *Ochlerotatus vigilax*. From week to week, numbers were between 'low' and 'high' with few trends evident, although collections were continuously above average towards the latter months of the season. No virus isolation was undertaken.

Port Stephens: mosquito densities and species composition varied between the trapping sites, although numbers early in the season were well above average and dominated by *Ochlerotatus vigilax*. Gan Gan had mostly 'high' collections throughout the season, with *Coquillettidia linealis* dominating. Numbers from this site were mostly around average. Saltash mainly yielded around average mosquito numbers, and were 'high' throughout most of the season. *Ochlerotatus vigilax* dominated at this site. Medowie also yielded mostly 'high' collections, although were mainly below average. The main mosquito species trapped at Medowie were *Coquillettidia linealis* and *Ochlerotatus vigilax*. Karuah consistently trapped above average numbers, especially during the early months of the season. 'High' numbers were yielded most weeks and strongly dominated by *Ochlerotatus vigilax*. Heatherbrae continues to trap the most mosquitoes for any site from Port Stephens, with 'very high' numbers from January to the end of March. Mosquitoes were unseasonably abundant in the early months. *Ochlerotatus vigilax* was the dominant species trapped at Heatherbrae, although freshwater species including *Coquillettidia linealis* and *Culex annulirostris* were also trapped in 'high' numbers. No virus isolation was undertaken.

Tweed Heads: collections were mostly 'low' and below average up to late February, with some 'high' trap numbers following through March from the Beltana Road site. No virus isolation was undertaken.

Wyong: trapping generally yielded 'low' to 'medium' numbers, which were around average for most of the season. Only one 'high' collection was made, which was in mid-January. No virus isolation was undertaken.

Sydney Locations

Blue Mountains: only two collections were made this season, which yielded 'low' numbers dominated by *Ochlerotatus notoscriptus*. Virus isolation was undertaken from the mosquitoes but no isolates were yielded.

Concord: mosquito collections were mostly 'medium' in number, although there were some 'high' collections in February and March, which were dominated by large numbers

of *Ochlerotatus vigilax*. No virus isolation was undertaken.

Hawkesbury: no mosquito collections were undertaken this season.

Parramatta: overall mosquito numbers were dependant on the densities of the dominant species, *Ochlerotatus vigilax*, which peaked during late January with one 'very high' collection from George Kendall Reserve. This site yielded the majority of mosquitoes, as it is closest to the breeding sites in and around Homebush Bay. Collections from George Kendall Reserve were consistently 'high' throughout the entire season. Carson St and Eric Primrose Reserve yielded 'medium' to 'high' collections, while Pennant Parade and Eccles Park yielded 'low' to 'medium' mosquito numbers. Virus isolation was undertaken from the mosquitoes but no isolates were yielded.

Penrith: only limited collections were made with traps set on four occasions. Mosquito collections were predominately 'low' in number. Virus isolation was undertaken from the mosquitoes but no isolates were yielded.

Ryde: the majority of the trapping yielded 'low' to 'medium' mosquito densities. Collections peaked during the first week of March with 'high' numbers from several sites, which were dominated by *Ochlerotatus vigilax*. Only the Lambert Park collections were processed for viruses, and none were isolated.

HUMAN NOTIFICATIONS

http://www.arbovirus.health.nsw.gov.au/areas/arbovirus/human/human.htm

Tables 2 and 3 contain the number of laboratory notifications of human RRV and BFV infections by Area Health Service (AHS) for NSW. Note that these are laboratory notifications based on a single IgM positive specimen, and may not always represent infections from this season, as IgM may persist for long periods. In addition to the figures in Tables 4 & 5, there were 25 unspecified arbovirus notifications.

The total number of arbovirus notifications for the period July 2002 to June 2003 (Figure 7) was 901 (including 453 RRV, 423 BFV, and the 25 unspecified) and this was slightly below the average for the previous five seasons of 930. Over 90% of the notifications were from the coast; the 817 human cases were well up from the previous five-year average of 658. In contrast, the inland had very few notifications, only 84, which is well below the previous five-year average of 273. Sydney had around one third the number of notifications this season, compared to recent years.

Table 2. Ross River virus notifications according to Area Health Service, July 2002 - June 2003.

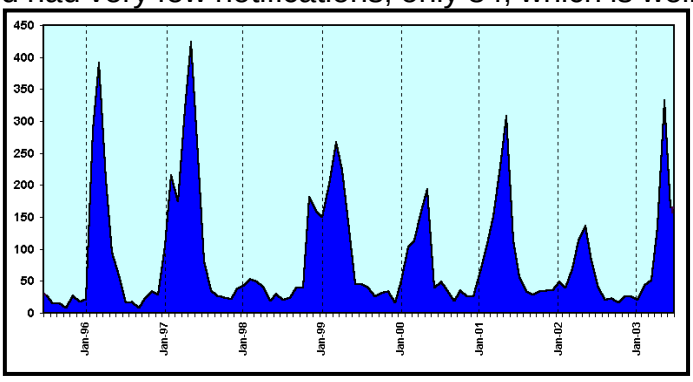


Figure 7. Reports of human cases of arbovirus infections by month in NSW, July 1996 - June 2003

Month	CS	NS	WS	WE	SW	CC	HU	IL	SE	NR	MN	NE	MA	MW	FW	GM	SA	Total
Jul	0	0	0	0	0	0	0	0	0	1	4	1	2	2	0	2	1	**13**
Aug	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	0	**3**
Sep	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	2	0	**4**
Oct	0	0	0	0	0	0	1	0	0	1	1	0	1	0	0	0	0	**4**
Nov	0	0	0	0	0	0	2	0	0	0	1	2	2	0	0	0	0	**7**
Dec	0	0	0	0	0	0	0	0	0	0	3	1	2	0	0	1	0	**7**
Jan	0	1	0	0	0	0	0	0	0	0	3	0	0	0	1	0	0	**5**
Feb	0	0	0	0	0	0	4	2	0	5	0	2	1	0	1	1	0	**16**
Mar	1	0	0	1	0	0	6	0	0	9	2	3	0	1	1	1	0	**25**
Apr	0	1	0	0	0	2	6	0	0	41	14	4	2	2	1	5	0	**78**
May	1	2	0	0	0	1	6	0	0	127	51	6	0	0	1	1	0	**196**
Jun	1	0	0	0	0	2	3	0	1	63	18	0	1	1	4	1	0	**95**
Total	**3**	**4**	**0**	**1**	**0**	**5**	**29**	**2**	**1**	**248**	**99**	**19**	**11**	**6**	**9**	**15**	**1**	**453**

Table 3. Barmah Forest virus notifications according to Area Health Service, July 2002 - June 2003.

Month	CS	NS	WS	WE	SW	CC	HU	IL	SE	NR	MN	NE	MA	MW	FW	GM	SA	Total
Jul	0	0	0	0	0	1	5	0	0	3	10	0	0	0	0	0	0	**19**
Aug	0	0	0	0	0	0	1	0	0	1	9	0	1	0	1	1	1	**15**
Sep	0	0	0	0	0	0	2	1	0	3	11	0	0	0	0	0	0	**17**
Oct	0	0	0	0	0	2	1	0	0	2	5	0	0	0	1	0	0	**11**
Nov	0	0	0	0	0	0	1	0	0	3	9	1	0	0	0	1	0	**15**
Dec	0	0	0	0	0	0	2	2	0	1	10	0	1	0	0	1	1	**18**
Jan	0	0	0	0	0	1	2	1	0	6	4	2	0	0	0	0	0	**16**
Feb	0	0	0	0	0	0	5	0	0	5	8	2	0	0	1	0	3	**24**
Mar	0	0	1	0	0	0	3	0	0	10	9	1	0	1	0	0	1	**26**
Apr	0	0	0	0	0	1	3	0	0	36	14	0	0	0	0	0	2	**56**
May	0	1	0	0	0	3	0	0	1	94	34	3	0	0	0	0	1	**137**
Jun	1	0	1	0	0	0	1	0	0	49	14	0	0	1	2	0	0	**69**
Total	**1**	**1**	**2**	**0**	**0**	**8**	**26**	**4**	**1**	**213**	**137**	**9**	**2**	**2**	**5**	**3**	**9**	**423**

CS = Central Sydney, NS = Northern Sydney, WS = Western Sydney, WE = Wentworth, SW = South Western Sydney, CC = Central Coast, HU = Hunter, IL = Illawarra, SE = South Eastern Sydney, NR = Northern Rivers, MN = Mid North Coast, NE = New England, MA = Macquarie, MW = Mid Western, FW = Far Western, GM = Greater Murray, SA = Southern Area.

The Northern Rivers Area Health Service received the highest number of notifications (461), almost double that of the next highest, the Mid-North Coast Area Health Service with 240 reports. Combined, these two areas had almost 80% of all the arbovirus notifications for the state.

DISCUSSION

The dry conditions, which began through the summer of 2000-2001 and halted the spread of the MVEV activity into the more populated regions of the state (Doggett *et al*., 2001, 2002), continued through 2002. The second half of 2002 had some of the driest conditions ever recorded for eastern Australia and water usage for agriculture was limited. The lack of available water for breeding ensured that mosquito populations towards the start of the season across inland areas were well below average. Minimal

rainfall through the early months of 2003 meant that mosquito numbers failed to rise substantially and overall collections from the inland were the lowest ever collected for the history of the surveillance program. Not surprisingly, with the low mosquito densities there was little arbovirus activity from inland regions. There were no identifiable viral isolates from the mosquitoes (a first for the history of the program), there were no seroconversions in the sentinel chickens and human notifications were the lowest seen for many years. Current predictive models are suggesting that MVEV activity is unlikely for the season of 2003-2004.

Coastal trapping continued to be limited, this year to five locations, with no sites from the south coast. The dry conditions across the inland during the start of the season were mirrored along the coast and mosquito numbers were mostly lower than normal. This pattern changed towards the latter part of the season especially for the far north coastal sites, as heavy rainfall was experienced through the months of February to April. As a result, high mosquito numbers developed and populations remained elevated even into mid-May. Interestingly, *Ochlerotatus vigilax* failed to rise in number, although high numbers of another saltmarsh species, *Culex sitiens* were yielded. Freshwater breeding mosquitoes such as *Ochlerotatus multiplex* and *Ochlerotatus procax* dominated the collections during these weeks. Following the high mosquito populations human notifications were well up, and this is discussed below.

With the low rainfall, the freshwater breeding mosquitoes from Sydney failed to rise substantially in number, although there were some large collections of *Ochlerotatus vigilax*. It was noticed during surveys at Homebush Bay that larval numbers of *Ochlerotatus vigilax* were much higher than normal (Cameron Webb, Department of Medical Entomology, *pers. comm*.) and this trend has been observed during drier weather patterns. Despite the ongoing management program, which yielded a high level of control, it was inevitable that adult mosquito numbers would be higher than usual with the high larval densities. There were no isolates yielded from the mosquitoes and the number of human notifications within the Sydney Region (5BFV & 9 RRV) was one of the lowest recorded.

In last season's annual report, it was noted that an intensive investigation of mosquito and arbovirus activity was conducted in Western Sydney at Werrington during February to May 2002, with many viral isolates yielded. Due to the dry conditions, this study was not continued during the recent season.

For four seasons running (1998-1999, 1999-2000, 2000-2001 & 2001-2002), the Mid-North Coast yielded the highest number of arbovirus disease notifications for any Area Health Service (AHS). The number of cases was again well up during the recent season (236 patients, with 99RRV & 137BFV), although it was surpassed by the Northern Rivers (461 patients, including 248 RRV & 213 BFV notifications). The Northern Rivers AHS also had the highest notification rates, with a crude rate of 172.5/100,000 per annum. This rate jumped to an extraordinary 983.7/100,000 (i.e. almost 1 patient in every 100 people!) during the month of May.

The high notification rates late in the season were due to a concurrent epidemic of RRV and BFV, which occurred through the months of February to May (the notifications from June were most likely from infections acquired in May as there is a lag time of around

two weeks from viral infection to illness/testing/notification). Activity of BFV has now occurred over three successive years along the northern coastal region (Table 4), although prior to the recent season, the focal point of activity has been within the Mid-North Coast AHS. This recent outbreak is now the largest recorded epidemic of BFV in Australia.

Table 4. Notifications of BFV & RRV from the Northern Rivers & Mid North Coast AHSs, over the last three mosquito seasons.

Virus	2000-2001	2001-2002	2002-2003	Total
Barmah Forest Virus	307	250*	350	**907**
Ross River Virus	215	82	347	**644**
Total	**522**	**332**	**697**	**1551**

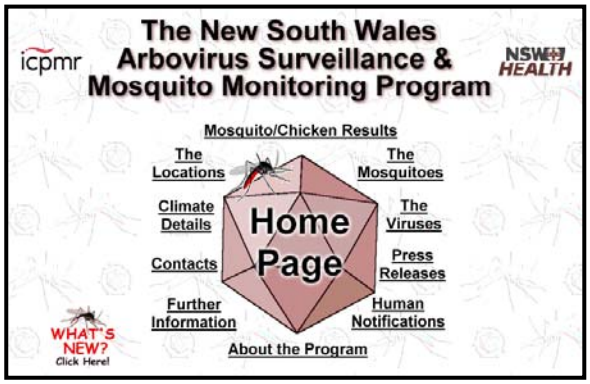
*The BFV activity was more widespread during 2001-2002, with over 100 cases from the Central Coast & Hunter AHSs.

As noted in the 2001-2002 report it is rare for BFV to be epidemic in consecutive seasons anywhere in NSW, or other states. It was postulated that the activity from the 2000-2001 outbreak might have been associated with saltmarsh mosquitoes. While in 2001-2002, there was evidence to suggest that freshwater mosquitoes could have been transmitting the virus. As these vectors vary in their habitat and geography, there may have been a demographically different human population exposed to the virus in the two outbreaks. For the recent activity, the focus of the BFV epidemic was in the Northern Rivers AHS, and again a slightly different demographic population may have been exposed. This speculation highlights the need for ecological studies on BFV to be undertaken. Information on the specific vectors and reservoir hosts in the area is non-existent, and data on the demographics of these past outbreaks is urgently required. This lack of information will seriously hamper disease reduction efforts in the future. Such research would be especially timely, as activity of this emerging disease has now occurred on three consecutive years and for each of these years, the number of cases state-wide has been gradually increasing (394, 406 & 423 BFV notifications for the seasons 2000-2001, 2001-2002 & 2002-2003, respectively).

THE NEW SOUTH WALES ARBOVIRUS SURVEILLANCE WEB SITE

http://www.arbovirus.health.nsw.gov.au/

The NSW Arbovirus Surveillance web site was established in early 1999 to facilitate the rapid dissemination of surveillance results (Doggett *et al.*, 1999). An additional important function is to provide information on mosquitoes and the arboviruses they transmit. Over the last year, the site has continued to grow to the current size of 139MB, and has 870+ pages of information.



Added to the site since the last annual report include:

- Revised human notification data,
- Weekly rainfall summaries,
- Monthly rainfall summaries, with long-term averages,
- Monthly rainfall and temperatures maps,
- Monthly SOI updates,
- Biweekly updates of human arbovirus notifications,
- An increase photographic collection of adult & larval mosquitoes, with images of all the major vectors as well as exotic risk species,
- Even more Press Releases relating to mosquitoes and arboviruses,
- The entire 2001/2002 Annual Report is accessible (under 'Further Information').

As of January 2003, statistics on the number of 'hits' (i.e. visits to the web site) were obtained (Table 4). As of July 2003, the web site is averaging around 25,000 hits/month, or extrapolated, around 300,000 annually.

Table 4. Number of hits to the NSW Arbovirus Surveillance Program web site.

Month	Jan-03	Feb-03	Mar-03	Apr-03	May-03	Jun-03	Jul-03	Total
Hits	22,353	19,033	20,996	20,416	31,288	21,598	18,577	**154,261**

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