REQUIREMENTS AND PROBLEMS FOR CONTROL OF SOME ARTHROPOD PESTS OF MEDICAL IMPORTANCE IN URBAN AUSTRALIA

RICHARD C. RUSSELL
University of Sydney, Department of Medical Entomology, Westmead Hospital, Westmead, NSW 2145, Australia

Australia has a range of insect and other arthropod pests presenting actual or potential medical and/or public health concerns for human communities.

Australian residential communities are diverse, encompassing small towns scattered throughout the vast landscape of both tropical and temperate environments, wet and dry, and arguably with characteristics that are peculiar to Australia, as well as large cosmopolitan urban centres similar to other major international cities.

Urban communities in Australia are afflicted with many of the same arthropods causing nuisance or presenting a disease risk as are communities in other countries, e.g. non-biting flies, cockroaches, lice, fleas, bedbugs and various mites. These are readily categorised as urban pests. However, the establishment of new suburban communities within or near natural environments, and the continuing expansion of existing urban areas into the surrounding natural bushland (still features of Australian development), provide opportunities for native insects, such as various biting flies, and other arthropods such as ticks, to become 'urban' pests.

With respect to those pests that fall within a stricter definition of urban pests, there are particular concerns in Australia about domestic mosquitoes as nuisance pests and as vectors of human and animal disease. The pest status of head lice and some mites (particularly dust mites and bird mites) may also be of interest to this conference.

With respect to natural habitat surrounding (and often within) urban communities, it is the biting flies and ticks which comprise the species of most concern, and the incidence of exposure varies from situation to situation, as might be expected. Ticks move little from the bushland habitat and afflict only those who enter that environment, whereas biting flies can disperse into domestic environments in search of bloodmeals and thus present a pest or vector threat. The principal biting fly pests in this regard are various 'rural' mosquitoes and biting midges. These are of substantial pest importance in some older and established urban centres, and in many developing urban areas of Australia. Biting midges (*Culicoides* species) continue to present a pest nuisance for suburban residents in some areas of the major cities sited on estuaries of the east coast, and the medical and public health importance of mosquitoes (particularly *Aedes* and *Culex* species) as vectors of arboviruses infecting humans has become increasingly recognised by health authorities in recent years.

Domestic mosquitoes continue to present a pest or disease threat in some urban areas of Australia. *Culex pipiens* group species (*Cx quinquefasciatus*, *Cx molestus*) associated with polluted drainage waters and septic tanks are decreasing in importance as urban pests with more effective disposal of effluent in major urban centres. But 'clean water' container breeders, such as some *Aedes* species, are still of concern as domestic pests and indeed disease vectors. An important case in point is dengue fever, an increasing concern because of the extent of activity of the dengue viruses in the Southeast Asian and Pacific regions and the concomitant threat of introduction to Australia, and also because dengue is now thought to be possibly again endemic in northern coastal Queensland. Although many human infections are imported annually to various parts of Australia, the vector *Aedes aegypti* currently exists only in the state of Queensland. Although some efforts at the community level are undertaken with surveillance and encouraging source reduction measures against this species in a few of the major urban areas, a greater political will is required at state and local government level to reduce the prevalence and geographic distribution of the vector in the state.

Proceedings of the First International Conference on Urban Pests.
K.B. Wildey and Wm H.Robinson (editors). 1993

As community participation, with a source reduction philosophy, should be the imperative for *Ae aegypti* control in Queensland, so should it be for control of *Ae notoscriptus* in New South Wales where that species is an important domestic pest for humans and a major vector of heartworm (*Dirofilaria immitis*) for dogs. The alternative circumstance, that where non-domestic or rural mosquitoes are presenting the threat to the community, is less readily combated.

Rural mosquitoes affect communities in many parts of Australia. Coastal localities are afflicted with saltmarsh mosquitoes (particularly *Aedes vigilax* and *Ae camptorhynchus*, but also *Cx sitiens* and *Anopheles hilli*) emanating from nearby estuarine habitats which are often precluded from adequate control because of the vastness of habitat involved or by concerns about environmental contamination or damage. Exceptions are occurring in a few areas where physical alterations of the drainage patterns on saltmarsh, with shallow ditches called runnels, appear to maintain the integrity and character of the environment, and its usage by non-target species, but result in a major reduction of mosquito production.

Also, many of the inland agricultural regions are experiencing an increase in pest mosquito (particularly *Cx annulirostris*) production, and increased risk of arbovirus transmission, because of the increasing use of irrigation in otherwise dry to arid zones. Concern for the costs associated with instituting chemical control programmes usually means that local authorities ignore the threats, and the institution of alternative irrigation practices which would militate against mosquito production is difficult to promote in the face of apparent apathy. Overall, this means that control of these pest populations, even when they affect the urban centres, is generally not attempted except in the event of an outbreak of disease.

The responsibility for control of pest mosquitoes usually rests with local authorities, such as municipal or shire councils, except where transmission of pathogens is widespread and state and federal health authorities may become involved. Unfortunately, in only few situations does any local authority, or group of contiguous local authorities, undertake routine pest abatement operations, let alone any preventive control procedures.

Community understanding of mosquitoes, their role in transmission of disease causing pathogens, and how individual citizens can assist in mosquito control through source reduction and other sanitation-type practices within the community, is increasing but not to an extent that there is much community involvement in mosquito control in urban Australia.

Many hundreds of cases of Ross River virus infection, resulting in debilitating polyarthritis, occur annually in communities of coastal and inland regions throughout the country, and there is a substantial economic cost to these communities because of the considerable morbidity associated with the disease. In recent years cases of local transmission have occurred in outer areas of the capital cities of mainland states.

The epidemiology of the disease is closely related to the ecology of the local mosquito vectors – various species in different situations. Protective measures for the community depend on an accurate identification of the most important vectors in local circumstances and, thereafter, appropriate vector control measures directed at the target species and the education of the community to avoid exposure to infection. Appropriate use of topical repellents containing diethyl toluamide is advised through outlets of health departments and the public media during periods of peak vector abundance or when arbovirus surveillance systems indicate current virus activity.

In the face of an apparently increasing incidence of Ross River virus, and some other arbovirus infections in communities throughout Australia, it has become apparent that more organised responsibility and direct action by local authorities is required to reduce the risk of urban outbreaks. The model of the Mosquito Abatement Districts of California, and the equivalent in Florida and other parts of the USA, is applicable to many parts of Australia, although the funding base would have to be adapted because of the smaller nature of the communities in Australia. There is already the examples of the success of joint local authorities groups in southeast Queensland/ northeast New South Wales, and in southwest Western Australia, in undertaking a concerted approach to mosquito control.

Ticks are typically not an urban problem, but they are a problem seasonally in bushland areas within and near urban communities in coastal eastern Australia. Tick paralysis associated with adult female ticks (*Ixodes holocyclus*) is now generally uncommon to rare in humans (although it remains a concern for dogs), and it is the larval stages which occur during summer which cause the

Proceedings of the First International Conference on Urban Pests.
K.B. Wildey and Wm H.Robinson (editors). 1993

greatest inconvenience because of their propensity to attach in large numbers and cause intense irritation in some people. Although the situation with respect to suspected Lyme disease in Australia is not yet resolved there is little evidence that any tick-borne spirochaetal infection has an urban association. Tick typhus (*Rickettsia australis*) however, although uncommon and primarily not an urban problem, does occasionally result from contact with ticks in bushland areas within suburban Sydney. Use of repellents with active ingredients such as diethyl toluamide are used by bushwalkers for protection in bushland areas, but no routine tick control is undertaken with respect to urban areas.

Head lice have become almost accepted within the communities of southern temperate Australia as part of the primary school 'education' (body lice appear to be relatively rare in Australia and apparently associated with persons living in deprived situations; pubic lice are presented occasionally for identification and advice on treatment but probably less often than would be required to assess their actual prevalence).

There have been few studies into the prevalence of headlouse infestation in Australia, and likewise few investigations of the efficacy of the various proprietary pediculicide treatments available through pharmacies and other commercial outlets. The only published reports of each come from Tasmania, where there has been a prevalence of approx. 2% in school children, and resistance to lindane and "pyrethroid products" (sic), and possibly malathion, has been indicated. There have been no published studies from the major centres of the mainland, such as Sydney and Melbourne.

Many parents still report problems with school officials attempting to exclude children exhibiting nits, after they have been sent home with a note advising that an infestation has been noticed and treatment is required. The National Health and Medical Research Council (NH&MRC), and most state Health Departments, advise that providing effective treatment has commenced, children should not be prevented from attending school simply because eggs are present on hairs.

In general terms, headlice continue to be a problem in Australia because of inadequate treatment: a lack of treatment guidelines for management of community infestations and inappropriate use of pediculicide products. More community education is an imperative, and should be directed towards a better understanding amongst parents that head lice are a community problem, that there is no stigma associated with infestation, and that children and contacts within and outside of the family of the person with an infestation must be treated effectively in order to control the problem within the community. Much of the problem may stem from the fact that the current generation of parents, family physicians and pharmacists, had no personal experience with headlice during their youth in the 1950s and 1960s.

Although reports of insecticidal resistance are widespread in literature from the northern hemisphere, there has been mostly only anecdotal reports from within Australia (with the exception of the Tasmanian report mentioned above); controlled trials are required. Many so-called treatment failures are apparently simple instances of poor application, reinfestations from untreated or inadequately treated contacts and, in some cases, misdiagnoses resulting from finding old eggs or 'pseudo-nits'). However, the prospect of insecticide resistance is recognised, even if the actuality is not confirmed in many areas, and rotational use of insecticidal products in urban communities has been advocated by the Health Departments of some states. For instance, in South Australia, the recommendation is for 3 years of malathion as the treatment of choice, with cases of apparent resistance to be treated on an individual basis with an alternative insecticidal product (e.g. pyrethrins or lindane), and for the following 3 year period the schedule is reversed, then reversed again.

Typically, over the past 2 decades, products containing lindane have been the standard treatment, although malathion, carbaryl and pyrethrin based products have also been available. Currently, organo-chlorine compounds such as lindane are no longer recommended by health authorities (and the principal lindane product in Australia is being discontinued by its marketing company), and the malathion and pyrethroid products are being promoted. Permethrin has only recently been approved by the NH&MRC for marketing as a pediculicide, and products containing this insecticide had not become available at the time of writing.

Mite problems are principally represented in the medical milieu by dermatoses due to scabies mite infestations, and allergies due to dust mites; with respect to nuisance pests the bird mites and stored product mites present the major problems.

Proceedings of the First International Conference on Urban Pests.
K.B. Wildey and Wm H.Robinson (editors). 1993

Dust mites, for their associated allergic and neurotic syndromes, are arguably the most important urban mites, at least by public perception, and are a continuing source of consultations. The highest prevalence of respiratory and dermatologic responses to *Dermatophagoides* spp. allergens (and perhaps other mite species which are components of house dust) is mainly associated with the more humid coastal cities and towns, rather than the inland urban centres with their typically much drier environments. Mite allergen levels in homes in the coastal regions of Australia are amongst the highest in the world, although many public buildings appear to have virtually no mites (possibly reflecting greater ventilation, lower humidity, and inhospitable furnishings); *Dermatophagoides pteronyssinus* is the most common (constituting approx. 95%) of the dust mite species in eastern Australia, *D. farinae* appears to be uncommon except in central Australia.

It is recognised that the success of control methods depends on reducing both mite populations and allergen loads (particularly mite faeces) within domestic environments. Thus urban preventive treatments have tended to concentrate on a 'sanitation' approach with techniques to kill mites and remove the dust containing their allergens, and remove the soft furnishings that accumulate dust and provide particularly productive habitats with moister, cooler microenvironments.

The use of occlusive covers for bed mattresses, the replacement of carpets with hard floor surfaces, the substitution of vinyl and leather for soft covers on chairs and sofas, or their 'cleansing' by hot washing and vacuuming, and the use of acaricidal and anti-allergen sprays, are all thought to be useful. Apart from the more familiar insecticides, a locally developed commercial product of modified tannin extracts that kills the mites and neutralises their allergens has been widely used in recent times.

Attention has recently been focussed on reducing the accumulation of mites in houses by an alternative preventive means, the designing of dwellings to maintain a sufficiently low humidity to make them generally unsuitable for mite colonisation. This was pioneered in Denmark using mechanical ventilation with heat recovery to reduce indoor air absolute humidity in winter to below 7.0 g/kg, equivalent to approx 45% RH. Such technology could provide a more appropriate community approach to this urban problem. However, it would be very difficult to implement a ventilation programme to reduce humidity in homes in coastal eastern Australia because the external humidities are usually above the 45%RH level (below which there would be destruction of mite populations) in most if not all months of the year. There is also a concern that excessive ventilation will produce aerosolised allergens and be counterproductive.

Bird mites (*Ornithonyssus bursa*) are a regular seasonal problem in urban areas of some cities, such as Sydney. These mites are particularly associated with pigeons, starlings and mynahs roosting and nesting in eaves, roof spaces, and window ledges of domestic or business premises. Mites invading the adjacent working or living spaces create a serious problem for many individuals, some of whom are very sensitive to the bites. Importation of office or laboratory supplies from warehouse or other storage areas infested with birds and mites, often introduces these mites (then known as 'paper' mites) to work places where they can cause serious personal discomfit and sometimes industrial conflict between workers and management. Despite the fact that many of the incidents are self-terminating, or can be alleviated by removal of the source and exclusion of the birds, some 'infestations' appear to 'persist' if the source is not readily identified, and may develop into more serious situations involving neuroses – delusions of parasitoses – which are difficult to resolve.

Some pest control companies tend to perpetuate the myth of 'paper mites', possibly with a view to the commercial profit associated with *ad hoc* or perhaps even routine treatments, and attempt to alleviate the infestations by insecticidal fumigation, unfortunately too often without any acknowledgement of the reality of the situation and without any serious attempt to investigate and eliminate the source. There is no data to support the presumption that fumigation with the various chemicals used will 'control' the situation.

Where the problem has been correctly identified, and the source of the infestation determined, removal of extant bird nests and installation of barriers to prevent reentry of birds (or rodents and their related 'nest mite' *O. bacoti*) has been shown repeatedly to preclude further problems within the building concerned. Use of insecticides can be unnecessary.

Proceedings of the First International Conference on Urban Pests.
K.B. Wildey and Wm H.Robinson (editors). 1993