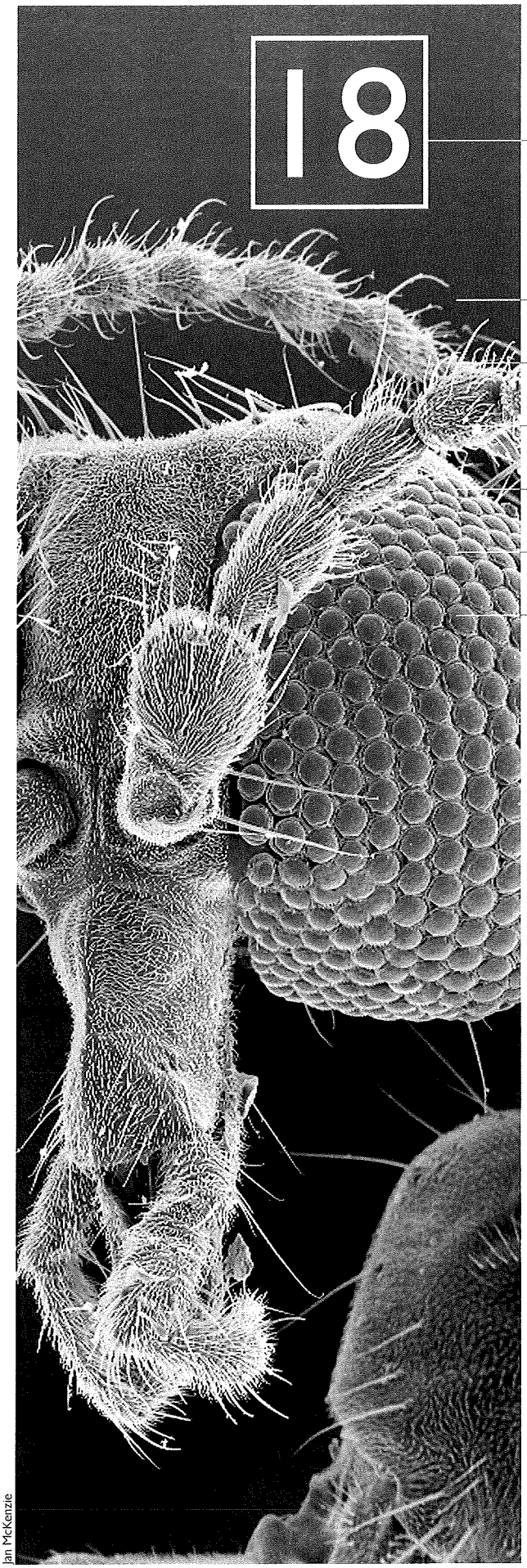

Jan McKenzie

18 Mosquitoes and Other Insect Pests

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18.3	Design Considerations	18-4
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Mosquitoes: *Culex*
Biting midges: Ceratopogonidae
Aquatic larval stage of various biting insects
Blackflies: *Austrosimulium*
Stephen Moore, Landcare Research

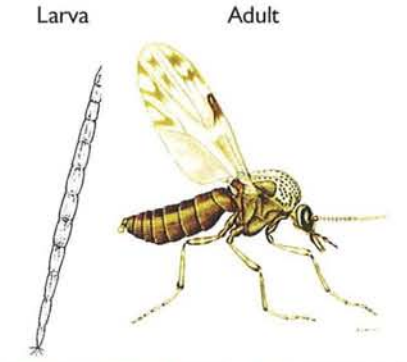
18.1 Biting Midges, Blackflies, and Mosquitoes

Flying nuisance insects such as biting midges (Figure 18-1), blackflies (Figure 18-2), and mosquitoes (Figure 18-3) are a natural component of pond and wetland fauna. The construction of any body of water may create some habitat for these insects. In natural environments, their numbers are normally controlled by natural processes such as predation. However, modified aquatic habitats in urban and rural areas can often create habitat beneficial to these insects.

Biting midges (Ceratopogonidae) are made up of two main groups; those that feed on the blood of vertebrates, and those that feed on the blood of other insects. There are about 120 species in New Zealand, of which six cause complaints. Little is known about their aquatic stage, although they are found in still or slowly flowing water (Winterbourn et al. 2000).

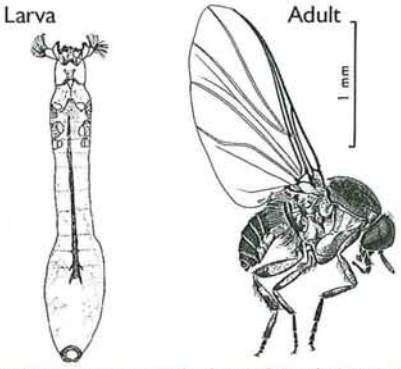
There are eleven described species of blackfly in New Zealand (in this country mistakenly referred to as sandflies), which are all from one genus; *Austrosimulium*. While the females of all blackflies can be a nuisance when they hover, land, and crawl over the body, only two species are likely to bite: *A. australense* (found throughout New Zealand), and *A. ungulatum* (found in the South Island and Stewart Island, Winterbourn et al. 2000). Blackflies have a sedentary larval stage, attaching themselves to stable substrate and obtaining food by filtering the water. As blackfly larvae are filter feeders they require some water flow to obtain food, and consequently do not occur in ponds or lakes. Their primary larval habitat is therefore different to biting midges and mosquitoes.

This chapter predominantly deals with mosquitoes, or more specifically *Culex pervigilans* and *Ochlerotatus notoscriptus*, which are the source of most complaints in Christchurch.



Source: Winterbourn et al. (2000) Source: ECORC (2002)

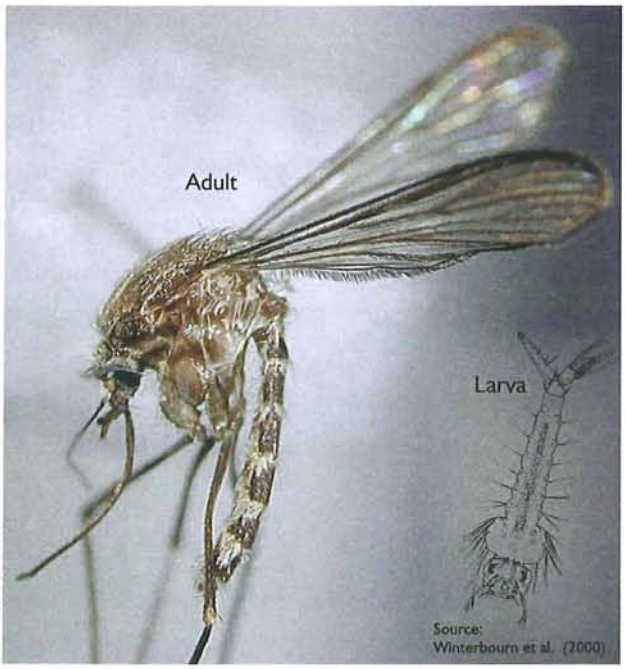
Figure 18-1: Aquatic larval stage and adult terrestrial stage of a biting midge (Ceratopogonidae). There is little known about the larval stage of Ceratopogonids in New Zealand.



CSIRO, Australia 1990, T. Binder

Source: Winterbourn et al. (2000) Source: Colless & McAlpine (1991)

Figure 18-2: Aquatic larval stage and adult terrestrial stage of a blackfly (Simulidae). In New Zealand these insects are commonly called sandflies, which is incorrect.



Peter Holder, NPPRL

Figure 18-3: Aquatic larval stage and adult terrestrial stage of the native mosquito, Culex pervigilans *(Culicidae), often known as container breeders.*

Peter Holder, NPPRL

Figure 18-4: Adult stage of the Australian banded mosquito, Ochlerotatus notoscriptus *(Culicidae, previously* Aedes notoscriptus*) found in Christchurch.*

Factors Contributing to Insect Pest Problems

When insects do become a nuisance (and possibly a public health risk in the case of mosquitoes), there are usually clear reasons why this occurs, such as:

- Changes in water and habitat quality resulting in a decrease in the numbers of predators: mosquito larvae can survive in poor aquatic habitats with low dissolved oxygen levels and ephemeral water, which may not be optimal habitat for predators.
- Accumulation of plant litter or the growth of particular plant species that isolates the shallow marsh habitat from predators. In many systems this results from natural water level fluctuations.
- Increasing proportion of areas of ponding or slow moving water that are beyond the reach of natural predators (frogs, fish, and insects).
- Climatic conditions that are conducive to the proliferation of mosquitoes.

18.2 Mosquitoes

Many people perceive mosquitoes to be the most irritating of wetland insects, and they can indeed create significant distress to adjacent residents. New Zealand has been fortunate so far to remain free from outbreaks of exotic diseases, so the nuisance created by mosquitoes arises mostly from skin irritation caused by their bite.

The most common indigenous biting mosquito in New Zealand is *Culex pervigilans* (Figure 18-3). They are container breeders, which can reproduce in small, enclosed water bodies such as buckets, tyres, cans, or spouting. While they do bite, they do not carry any diseases and are relatively innocuous.

The Australian banded mosquito (originally called *Aedes notoscriptus*, now called *Ochlerotatus notoscriptus;* Figure 18-4), is also a container breeder, and is the second most common mosquito in Christchurch. This mosquito is far more aggressive than the indigenous *Culex* species, and has become a nuisance in several areas in Christchurch. Another mosquito commonly found in Christchurch is *C. quinquefasciatus.*

In recent years the Christchurch City Council has established a monitoring programme for mosquitoes, in association with Crown Public Health. Sampling occurs in six major wetland areas where larvae are monitored, and records of public complaints from mosquito bites are kept from areas throughout the city. The two species *C. pervigilans* and *O. notoscriptus* are the focus of public complaints. Crown Public Health propose to trap the larval and adult stages of mosquitoes for future monitoring. Local authorities including Crown Public Health, the Ministry of Health, National Institute of Water and Atmospheric Research (NIWA), and environmental consultants are all working in collaboration to monitor and manage mosquitoes. A joint seminar was held in Christchurch in April 2002, where agreement was reached to jointly share knowledge and expertise about managing mosquitoes.

Residents near waterbodies should be cognizant that:

- Female mosquitoes require a blood source to enable egg laying. They target warm blooded animals such as birds and mammals, including humans. The eggs are laid in waterbodies, where development from the egg through to emergence of the adult takes around 8–10 weeks, however, this can vary considerably with water temperature and food availability.
- Mosquitoes can travel some distance for food (blood). Most travel up to 100 m and some up to tens of kilometres, often carried on the wind.
- Mosquitoes are wind carried, so wind direction assessment in relation to mosquito habitat and outside entertainment is important.
- Mosquitoes are attracted to overhanging canopy vegetation that provides shade and shelter during the day, but are attracted to light and CO_2 during the night. Note however, that some types of vegetation overhanging a waterway can assist in reducing mosquito populations.
- Experience to date has indicated that mosquito nuisances on private properties predominantly come from container breeding *C. pervigilans* and *O. notoscriptus.* If a problem arises, discarded or stored containers, spouting, planter trays and sumps on private properties should be checked for mosquito larvae.

There is a Mosquitoes brochure (Ministry of Health 1998) available from the Ministry of Health that outlines what you can do to prevent mosquitoes from becoming established around the home.

18.3 Design Considerations

Careful design of waterways and wetlands is important to minimize both the nuisance from current resident insects of all types, and potential risks from new species that may reach our shores in future.

While flying nuisance insects are a natural component of pond and wetland fauna there are some basic design suggestions for waterways and wetlands that will help keep their numbers low, thereby reducing public health risks (Table 18-1, see over page).

Some design considerations for combining good insect pest management practice with natural wetland and pond design include the following (modified from Wong et al. 1999). These considerations are particularly applicable to mosquito larvae.

- Ensure predators such as insects (backswimmers, damselfly larvae; Figure 18-5), fish (trout, bullies, mudfish; Figure 18-6), and frogs (Figure 18-6) have access to all parts of the water body. This includes ensuring a permanently inundated portion that acts as a predator refuge.
- Create habitat for these predators. Overhanging vegetation and aquatic plants provide additional habitat and cover for predators. Refer to *Chapter 3.2: Instream Communities and Their Habitat,* for habitat preferences of some of these predators.
- Introduce predators from existing ponds.
- Limit shallow water breeding areas by facilitating predator access to pond margins. Achieve this by retaining open water of some depth (at least 100 mm) to the pond edge and around plants.
- Ensure that the system experiences a natural water level fluctuation. Such fluctuations can interrupt the breeding cycle of some species and strand larvae. This is likely to be more applicable to blackfly larvae, which are sessile. However, ensure that any drawdown does not create pools separated from predators in the main body of water.
- Consider providing a distinct wetting and drying cycle for the system. Current Australian research indicates that this can help to maintain desirable vegetation composition, break down plant litter, and avoid excessive habitat partitioning by plant litter build-up. Note that the impacts of a wetting and drying cycle on useful predator species and other animals need to be assessed first.
- Ensure that human-derived litter (bottles, cans, cartons) does not accumulate in the system and act as an isolated breeding area for container breeding mosquitoes and other pests.
- Avoid directing low or trickle flows into overland flow paths. Where overflow paths are very flat or are used regularly, provide sub-surface drainage.
- During construction and maintenance, avoid the use of heavy machinery that creates wheel ruts, isolated pockets, and impedes uniform drainage.
- Undertake regular monitoring of any sediment accumulation in wetlands to ensure accumulation is not causing isolated pools or stagnant water.

Consult a freshwater ecologist or entomologist for specific advice on nuisance insect control and the impacts of control on other aquatic organisms.

Table 18-1. Basic aquatic habitat factors of waterways and wetlands that will encourage or discourage mosquito larvae.

Encourage Pest Populations	Discourage Pest Populations
Warm, stagnating water (optimal larval habitat)	Clean, fresh, moving water (> 0.2 m/s)
Shallow water and dense vegetation	Steep bank sides and few areas of still, shallow water
	Deep water (> 0.15 m) to the water's edge
	Presence of predators

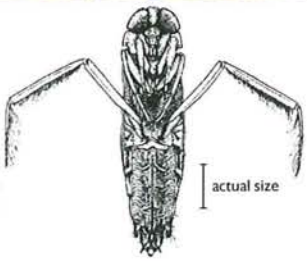


Figure 18-5: Damselfly larvae (above) are ambush predators that prey on mosquito larvae. Backswimmers (right) are also mosquito predators. Like damselflies, they prefer areas of low water velocity, and aquatic vegetation.

Winterbourn et al. (2000)

Angus McIntosh

Figure 18-6: Native Canterbury mudfish (above) are predators of aquatic mosquito larvae, whereas frogs (right) are predators of the adult terrestrial stage of mosquitoes. The common frogs of Christchurch are native to Australia.

18.4 Reporting an Insect Problem

Report insect problems to the Environmental Health Officer, in the Environmental Services Unit of the Christchurch City Council. The Environmental Health Officer will determine whether a problem relates to private or Council land, and will investigate problems that originate on private properties. The Parks and Waterways Unit will be advised if insect problems originate from one of its facilities and will take appropriate action.

Should mosquitoes breeding in open water cause a problem, usual Council action is that a contractor will be engaged to apply a larvicide. The recommended spray is *Bacillus thuringiensis* (Bti; trade name "Vectobac"). An extract from bacteria, Vectobac is approved for use and is specific to mosquitoes and blackflies. It is applied in very low doses and has no known adverse effect on other species.

Note that the Christchurch City Council is currently reviewing its use of herbicides and insecticides, with the aim of minimizing their future use.

18.5 References

Colless, D. H. & McAlpine, D. K. 1991. Diptera (flies). In: Commonwealth Scientific and Industrial Research Organisation (CSIRO), Division of Entomology. *The Insects of Australia: A Textbook for Students and Research Workers.* Cornell University Press, Ithaca. Pp. 656–740.

ECORC (Eastern Cereal and Oilseed Research Centre) 2002. Web site: http://res2.agr.ca/ecorc/program2/entomology/biting_flies/english/midge.html

Ministry of Health 1998. Mosquitoes: why we need to clean up our own back yards. Information brochure (May 1998). Ministry of Health, Christchurch. Available from the Christchurch City Council.

Wong, T. H. F., Breen, P. F., Somes, N. L. G. & Lloyd, S. D. 1999. *Managing Urban Stormwater Using Constructed Wetlands* (2nd ed.). Cooperative Research Centre (CRC) for Catchment Hydrology Industry Report 98/7. CRC for Catchment Hydrology, Victoria.

Winterbourn, M. J., Gregson, K. L. D. & Dolphin, C. H. 2000. *Guide to the Aquatic Insects of New Zealand.* Bulletin of the Entomological Society of New Zealand 13. Entomological Society of New Zealand, Auckland.