

## **Mosquitoes (Diptera: Culicidae) breeding in artificial habitats at the Wellington Zoo**

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New Zealand is under serious risk of a mosquito-borne disease outbreak (Derraik & Calisher 2004) and more research is needed to better understand the ecology of culicids in this country. The high density of introduced animals within zoos is likely to benefit mosquitoes, in particular exotic species, as shown by a recent investigation in the Auckland Zoological Park (Derraik in press). A study carried out in the Wellington Zoo also showed that the density of adult mosquitoes was considerably higher than in a native forest site just a few kilometres away (Derraik *et al.* 2003).

In the Wellington Zoo study, a few specimens of the endemic *Culex* (*Culex pervigilans* Bergroth) were recorded in adult traps (Derraik *et al.* 2003), but this species was absent from monitored ovitraps and tree hole habitats in which the exotic *Ochlerotatus* (*Finlaya*) *notoscriptus* (Skuse) was the sole species recorded (Derraik, unpublished data). I set out therefore, not only to study the potential artificial breeding habitats for mosquitoes in the Wellington Zoo grounds, but also to identify the sources of the adult *Cx. pervigilans* recorded.

A one-off inspection of all accessible artificial breeding habitats was carried out in March 2002. Eight such habitats were found, all of which were larva-positive for culicids (Table 1). In four cases *Cx. pervigilans* was abundant and found in association with *Oc. notoscriptus*, while the latter species was the only one recorded in the remaining habitats (Table 1). The density of larvae in some habitats was remarkable, and I estimated that several thousand larvae of *Cx. pervigilans* and *Oc. notoscriptus* were present in each of the two abandoned bathtubs inspected. These were filled to the rim and contained somewhat putrid water (green and turbid) in which a few rotting bird corpses were present. The other container with a very high density of both species was a plastic drum placed in the shade outside the emu enclosure (and was used to keep the animals' foliage fresh).

Although I did not closely inspect all animal enclosures, all but one of the artificial ponds (for drinking and bathing) that I was able to investigate had running water.

**Table 1.** Collection records of *Culex pervigilans* and *Ochlerotatus notoscriptus* from artificial containers at the Wellington Zoo. The number of records for any particular habitat and the respective species recorded is indicated.

Larval Habitat Description [no.]	<i>Oc. notoscriptus</i>	<i>Cx. pervigilans</i>
Abandoned bathtub [2]	X	X
Abandoned kitchen sink [2]	X	
Artificial pond (with stagnant water) [1]	X	X
Metal drum [1]	X	
Plastic drum (for animal foliage) [1]	X	X
Plastic drum (for animal foliage) [1]	X	

The one with stagnant water was, not surprisingly, thriving with larvae of both *Cx. pervigilans* and *Oc. notoscriptus*. Note that I did not find culicid larvae in any natural ground waters.

Overall, even though the Wellington Zoo was found to offer few artificial breeding grounds for culicids, most of the ones I encountered contained extremely high densities of mosquitoes. The absence of *Cx. pervigilans* from the ovitraps monitored (Derraik, unpublished data) might be explained by the fact that this endemic species is not a container breeder *per se* (Belkin 1968). In the Wellington Zoo, it only thrived in the larger container habitats (in particular the bathtubs) and it was absent from the two smallest containers (abandoned sinks; Table 1). In relation to *Oc. notoscriptus*, the abundance of this species' larvae in containers fully exposed to sunlight was of interest, as the species seems to be particularly intolerant of direct sunlight (Graham 1929, Laird 1990). This exotic species, which is the second most common mosquito in the North Island (Hearnden 1999, Laird 1990), seems to be becoming the main mosquito breeding in anthropogenic habitats in the Wellington region, even though it only appears to have gained a foothold in the province 10 years ago (Laird & Easton 1994).

*Culex pervigilans* is a vector of New Zealand's only native arbovirus, the Whataroa virus (Maguire *et al.* 1967), which is known to infect birds even though the infection is clinically unapparent (Miles *et al.* 1971). Holder *et al.* (1999) recently suggested that this species may also have a role in the transmission of avian malaria. *Ochlerotatus notoscriptus* in contrast, is a known vector of diseases affecting man and animals alike, including *Dirofilaria immitis* (canine heartworm), myxomatosis (Lee & Bugledish 1999), Ross River virus (Russell 1995; Watson & Kay 1997), Barmah Forest virus (Watson & Kay 1999) and Rift Valley Fever (Turell & Kay 1998).

As a result, the thriving populations of these two species in the Wellington Zoo and other zoological parks could turn such facilities into important focuses of disease, where the potential for contact between infected person, vector, and reservoir would be maximized (Derraik in press). Therefore, mosquito control programmes should be made part of the routine management procedures to mitigate the risk of disease transmission to both animals and humans in zoos, and reduce levels of mosquito-related stress for captive animals.

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