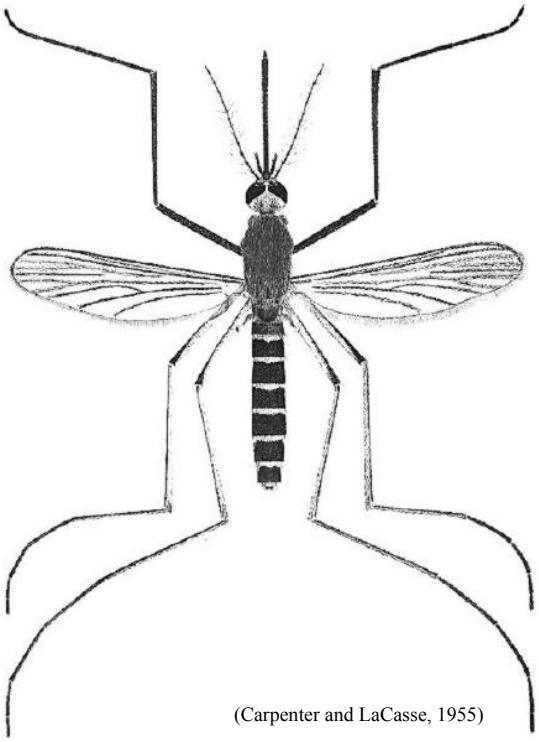
Culex pipiens complex

NZ Status: Not present – *Cx. pipiens pallens* is an Unwanted Organism



(Carpenter and LaCasse, 1955)

Vector and Pest Status

Mosquitoes in the *Culex pipiens* complex are important disease vectors with global distribution. They are vectors of St. Louis encephalitis virus in eastern and south central North America (Tsai and Mitchell, 1989), West Nile virus in northeastern United States (Lanciotti *et al*., 2000) and Europe (Hubalek and Halouzka 1999), Rift Valley fever virus (Meegan, 1979), *Wuchereria bancrofti* (Farid *et al*., 2001), *Dirofilaria immitis* (dog heartworm) (Lai *et al*. 2000), and bird malarias such as *Plasmodium relictum* (Atkinson *et al*., 1995 in Cornel *et al*. 2002).

Culex pipiens f. molestus is known to carry Murray Valley encephalitis in the laboratory but its potential as a vector is unknown (Russell, 1993).

Taxonomy

At present the *Cx. pipiens* complex includes five species: *Cx.* (*Cx.*) *pipiens* Linnaeus, *Cx*. (*Cx.*) *quinquefasciatus* Say, *Cx*. (*Cx.*) *pipiens pallens* Coquillett, *Cx*. (*Cx.*) *australicus* Dobrotworsky and Drummond, and *Culex* (*Cx.*) *globocoxitus* (Dobrotworsky and Drummond). However, *Culex pipiens* has two distinct forms; form

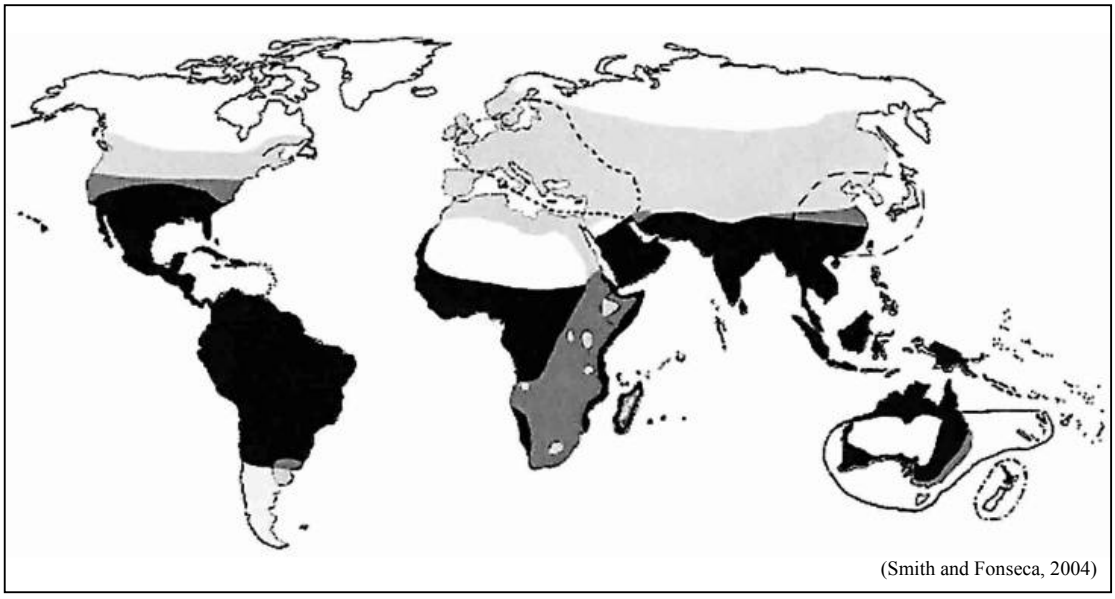
pipiens and form molestus Forskal (Harbach *et al*., 1984; Bahnck and Fonseca, 2006). Currently, *Culex pipiens pallens* is the only member on the unwanted organisms list.

Morphologically members of the species complex are very hard to differentiate. Smith and Fonseca (2004) have developed molecular assays that identify the members of the *Cx. pipiens* complex and other sibling species across several geographic regions worldwide. This study also detected introgression (process by which new genes are introduced into a wild population by backcrossing of hybrids between two populations) between *Cx. pipiens* and *Cx. quinquefasciatus* (Smith and Fonseca, 2004). Bahnck and Fonseca (2006) have also developed a rapid assay to identify the two genetic forms of *Cx. pipiens*, form pipiens and form molestus. This allows the identification of pure and hybrid populations of the two *Cx. pipiens* forms as well as those including *Cx. quinquefasciatus* (Bahnck and Fonseca, 2006). *Culex torrentium* and *Cx. pervigilans* are mentioned in the geographic distribution as they are morphologically similar to but no longer part of the *Cx. pipiens* complex (Smith and Fonseca, 2004).

According to a study by Fonseca *et al*. (2004), which included 33 populations of species in the complex, specimens designated *Cx. molestus* from Pt. Willunga in South Australia were placed in the European underground *Cx. pipiens* group which is also present in North Africa, the Middle East and Japan. *Culex molestus* is presently classed as a synonym of *Cx. pipiens* (Fonseca *et al*., 2004).

Geographic Distribution

The distribution of the *Culex pipiens* complex and its sibling species are displayed on the map below ex Smith and Fonseca (2004).



(Smith and Fonseca, 2004)

Light grey = *Cx. pipiens*; black = *Cx. quinquefasciatus*; dark grey = overlapping ranges of *Cx. pipiens* and *Cx. quinquefasciatus*; region marked by dotted line = *Cx. torrentium*; region marked by solid line = *Cx. australicus*; region marked by dashed line = *Cx. pipiens pallens*; New Zealand marked by dotted and dashed line = *Cx. pervigilans.*

The *Culex pipiens* complex in Japan consists of three taxa, *Cx. quinquefasciatus*, *Cx. pipiens pallens* and *Cx. pipiens molestus. Culex quinquefasciatus* is distributed throughout the Ryukyu Islands and Ogasawara Islands. The other two are found thoughout the main Kyushu Islands and northwards, but not in the southern parts such as Okinawa (Oda *et al*., 1999).

Culex quinquefasciatus is widespread throughout the tropics, subtropics and warm temperate regions of the world (Lee *et al*., 1989). It is important to note this species is present in both Australia and New Zealand.

Culex australicus is present in Australia and possibly New Caledonia and Vanuatu (Lee *et al*., 1989). However, the latter two distribution records need to be confirmed

Culex globocoxitus is only present in Australia (NSW, Victoria, South Australia, Tasmania, southwest Queensland and southwest Western Australia) (Russell, 1993).

Incursions and Interceptions

Cx. pipiens pallens has only been intercepted once in New Zealand. An adult male was collected from a 44 gallon drum on the deck of a ship at the Ports of Auckland on the 20th September 2001. The ship originated from Japan and arrived in New Zealand via Hong Kong.

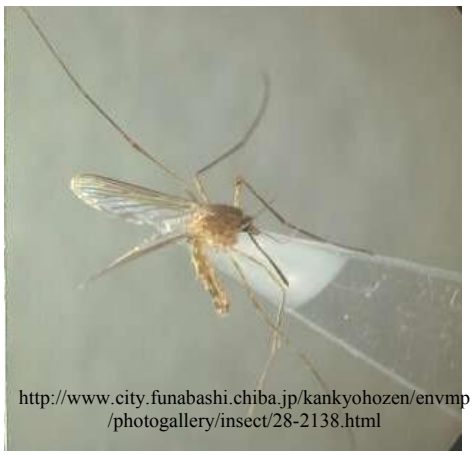
Culex australicus specimens have been intercepted on two occasions in New Zealand. A live female adult was collected on the 5th December 2005 at Christchurch Airport, in a plane originating from Melbourne, Australia. A female adult was also collected in Dunedin inside a shipping container also from Melbourne on the 25th May 2006.

Culex quinquefasciatus has been intercepted at air and shipping ports on a number of occasions. As this species is already present it New Zealand it is unknown whether adults and larvae collected have a New Zealand or overseas origin. At least six interceptions of this species are of overseas origin, which was determined by a number of factors related to their collection. Molecular testing of intercepted specimens would help identify if the specimens were of New Zealand origin or not.

Culex globocoxitus and *Culex pipiens* have not been intercepted in New Zealand to date.

Habits and Habitats of each of the *Culex pipiens* complex

Culex pipiens pallens



http://www.city.funabashi.chiba.jp/kankyohozen/envmp/photogallery/insect/28-2138.html

This species is a primarily domestic species occurring in urban areas, close to human habitation (Tanaka *et al*., 1979). Larvae occur in a very wide variety of artificial containers, subterranean habitats, ditches, gutters and ground pools with polluted water and containing abundant organic matter (Oda *et al*., 1999).

Culex pipiens pallens females lay eggs after taking a bloodmeal (Oda *et al*., 1999). They are primarily avian feeders, but will also feed on humans and mammals (Tanaka *et al*., 1979).

Females of this species can exhibit diapause (Oda *et al*., 1999).

Culex australicus

Larvae have been found in a number of habitats including ground pools, hoofprints, rock pools in creeks, and larger artificial containers, drains, irrigation ditches and rice fields; effluent ponds and sewage treatment works, normally in freshwater but occasionally in brackish situations (Lee *et al*., 1989; Russell, 1993). This species does not normally bite humans and appears to feed predominantly on rabbits and birds (Dobrotworsky, 1965).

Culex globocoxitus

Larvae are usually found in freshwater, in open swamps, grassy ground pools, drainage pits, waterholes and artificial containers such as tanks, troughs and wells. This species can tolerate brackish and polluted water (Lee *et al*., 1989). Adult females do not normally bite humans but may feed on birds and rabbits (Russell, 1993). This species is capable of carrying Murray Valley encephalitis under laboratory conditions (Lee *et al*., 1989).

***Culex pipiens* – northern house mosquito**
(*Culex pipiens* f. pipiens *and Culex pipiens* f. molestus)

There are several differences between the two forms of *Culex pipiens, Culex pipiens* f. pipiens diapauses, requires a blood meal to lay eggs (anautogeny), and is unable to mate in confined spaces, whereas *Culex pipiens* f. molestus does not diapause, is able to lay its first batch of eggs without a blood meal (autogeny), and mates in confined spaces (Mattingly *et al*., 1951; Bahnck and Fonseca, 2006).

In Japan, *Cx. pipiens* f. molestus occurs most frequently in underground water pools and occasionally in open water (Oda *et al*., 1999). Larvae of *Cx. molestus* in Australia are found in sewerage ponds, septic tanks and other polluted ground and container water, drainage pits (Russell, 1993). This form is often found in domestic areas, but also in sylvan areas (Russell, 1993), will attack humans and birds readily at night and can be a serious domestic pest indoors in certain areas (Russell, 1993).

A temperature study found that the survival of *Cx. pipiens* f. molestus was adversely affected by temperatures of 28°C and higher (Oda *et al*., 1999).

In the United States, blood meal analysis revealed that *Cx. pipiens* f. pipiens bites both humans and birds, suggesting they may serve as bridge vectors of the West Nile Virus from birds to humans (Spielman, 2001 in Fonseca *et al*., 2004). One of the reasons because they are often the most common mosquitoes in urban areas (Fonseca *et al*., 2004).

***Culex quinquefasciatus* – southern house mosquito**

This species is a domestic container breeding species which breeds in all kinds of artificial habitats containing polluted water such as wells, tanks, fountains, drains, septic tanks (Lee *et al*., 1989). *Culex quinquefasciatus* is generally associated with more eutrophic waters than *Cx. pipiens* (Savage and Miller, 1995). This species is a nocturnal biter and usually attacks indoors and outdoors from 10 pm onwards (Lee *et al*., 1989).

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