



NEW ZEALAND BIOSECURE

Entomology Laboratory



Anopheles Genus

Anopheline mosquitoes

NZ Status: Not Present – Unwanted Organisms



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Anopheles annulipes

Vector and Pest Status

There are over 400 species of the genus *Anopheles*, about 70 of these are human malaria vectors with approximately 40 species considered important vectors (Service, 2000). There are four parasites that cause human malaria; *Plasmodium falciparum*, *P. vivax*, *P. ovale* and *P. malariae*, all four are transmitted only by *Anopheles* species. Each year 350-500 million cases of malaria occur worldwide, and over one million people die, most of them young children in sub-Saharan Africa. (www.cdc.gov/malaria).

Anopheles species are vectors of many other disease agents including;

- Bancroftian filariasis (*Wuchereria bancrofti*) – e.g. *An. gambiae s.l.* and *An. funestus* (Boakye *et al.*, 2004)
- Malayan filariasis (*Brugia malayi*) – e.g. *An. sinensis* (Zhang *et al.*, 1991)
- filariasis (*Brugia timori*) - e.g. *An. barbirostris* (Partono *et al.*, 1977)
- Ross River virus - e.g. *An. amictus* (van den Hurk *et al.*, 2002)
- Cache Valley virus - e.g. *An. quadrimaculatus* (Blackmore *et al.*, 1998)
- O’Nyong Nyong virus - e.g. *An. gambiae* (Brault *et al.*, 2004).

Anopheles species can transmit pathogens such as dog heartworm (*Dirofilaria immitis* and *Dirofilaria repens*) (Cancrini *et al.*, 2006), various species of *Brugia*, such as *B. patei* and *B. pahangi* which infect animals but not people, and myxomatosis (Service, 2000).

Other viruses that have been isolated from various *Anopheles* species include

- Kowanyama - e.g. *An. amictus* and *An. annulipes* (Lee *et al.*, 1987)
- Trubanaman - e.g. *An. annulipes* (Lee *et al.*, 1987)
- Mapputta - e.g. *An. annulipes* and *An. amictus* (Standfast *et al.*, 1984)
- Sindbis - e.g. *An. meraukensis* (van den Hurk *et al.*, 2002)
- Bovine ephemeral fever - e.g. *An. bancroftii* (Standfast *et al.*, 1984)
- Eubenangee – e.g. *An. farauti* (Standfast *et al.*, 1984)

Geographic Distribution

Anopheles mosquitoes have a world wide distribution, not only in the tropical regions but also in the temperate regions. They are found in south Asia, North, Central and South America, Australia, China, Tropical and Sub-Saharan Africa, North Eurasia, India-Iran, Papua New Guinea, the Pacific, the Mediterranean and Arabia (Service, 2000).

There are no *Anopheles* species present in Antarctica. (Service, 2000) or New Zealand. Any transmission of malaria in New Zealand would therefore be dependent on the introduction of an exotic vector. All potential malaria vectors in the Australia-Pacific region are tropical species, and are unlikely to survive in New Zealand (Boyd and Weinstein, 1996). The exception is *An. annulipes s.l.*, a complex of Australian mosquitoes which includes several cold tolerant sibling species, some of which are believed to have transmitted malaria in areas with temperate climates (Boyd and Weinstein, 1996).

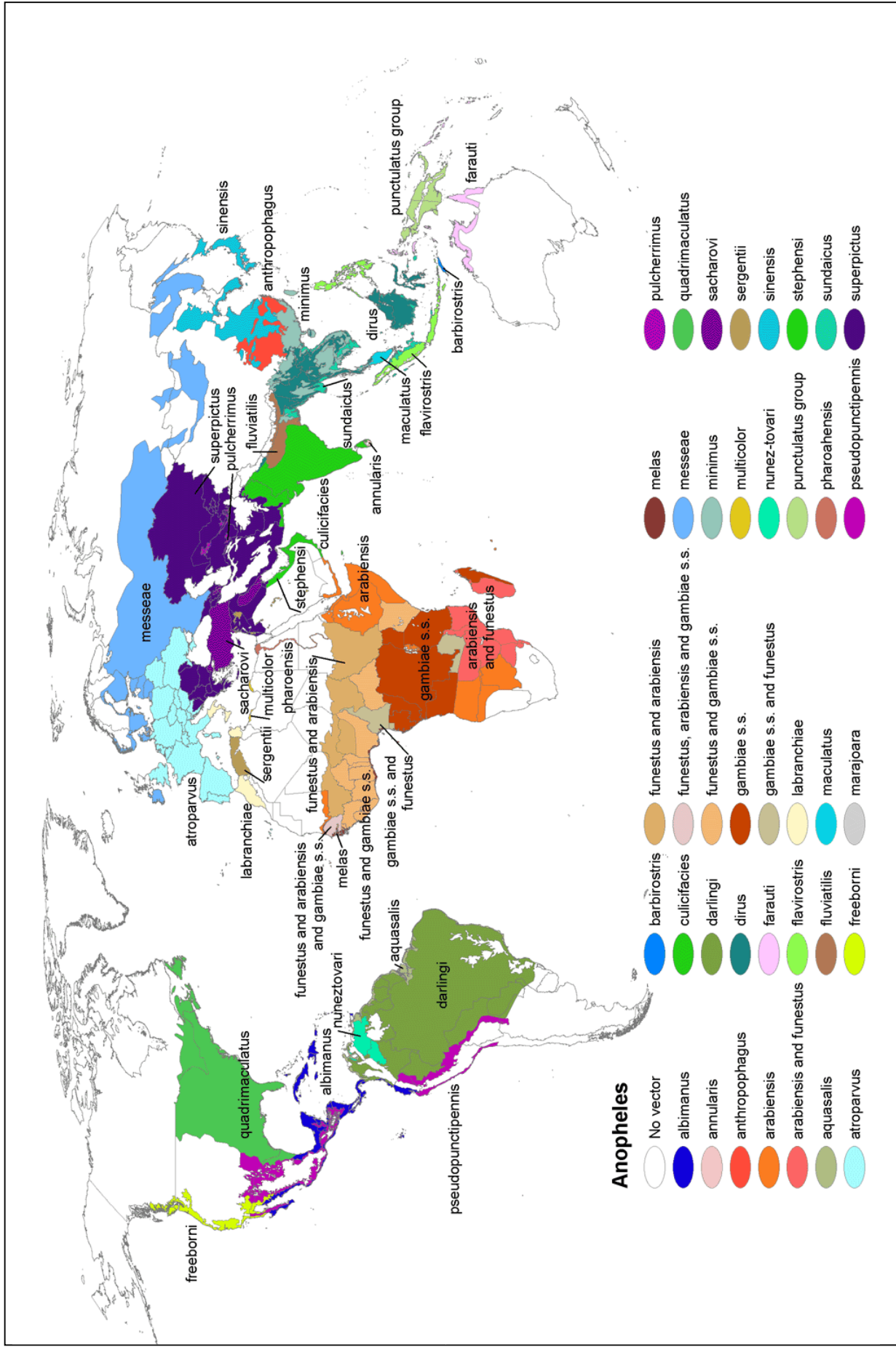
Incursions and Interceptions

Anopheles species have been intercepted in New Zealand on a number of occasions. Unidentified *Anopheles* species have been recorded as being intercepted on an aircraft from Australia, twice between 1955 and 1965 (Manson and Ward, 1968; Derraik, 2004), and from a cargo ship from USA, in 2001 (MAF unpublished data, Derraik, 2004). *Anopheles maculipennis* was collected twice in 1929 on ships from the East Indies and Indonesia (Graham, 1939; Derraik, 2004). *Anopheles stigmaticus* was also intercepted in New Zealand on a cargo plane from Australia in 2001 (MAF, unpublished data, Derraik, 2004).

Taxonomy

By the end of 1995, 425 formally named species and 36 unnamed members of species complexes were recognized as distinct morphological and/or biological species of the *Anopheles* genus (www.wrbu.org). Six subgenera are currently recognized in the genus *Anopheles*, namely *Anopheles* (present in all zoogeographic regions) (182 species), *Cellia* (Australasian, Oriental and Afrotropical with minor representation in Palaearctic) (227 species), *Kerteszia* (Neotropical) (12), *Nyssorhynchus* (Neotropical with minor extension to Neartic) (30 species) and *Stethomyia* (Neotropical) (5 species) (Lee *et al.*, 1987; www.wrbu.org). The three largest subgenera are further divided into sections, series, and groups (www.wrbu.org). Only the subgenera *Anopheles* and *Cellia* are represented in the Australasian Region and none are present in New Zealand (Lee *et al.*, 1987).

Global distribution of dominant or potentially important malaria vectors



The main feature distinguishing adult mosquitoes of the genus *Anopheles* from all other mosquito genera are the palps, which are about as long as the proboscis in both males and females. The main distinguishing feature of the larvae is that they do not possess a siphon. Eggs are boat-shaped due to the presence of lateral or dorsal floats.

Habits and Habitats

The habits and habitats of *Anopheles* are species-specific. *Anopheles* larvae occur in many different types of large and more or less permanent habitats, ranging from fresh- and salt-water marshes, mangrove swamps, grassy ditches, rice fields, edges of streams and rivers and ponds and drainage pits (Russell, 1993; Service, 2000). They are also found in small and often temporary breeding places such as puddles, hoofprints, wells, discarded tins and sometimes water-storage pots. A few species such as *An. bellator* and *An. cruzzi* breed in tree-holes and some in the leaf axils of plants e.g. bromeliads (Service, 2000).

Most *Anopheles* species are crepuscular or nocturnal in their activities. Oviposition normally occurs in the evenings, at night or in the early morning around sunrise (Service, 2000). After mating and blood-feeding, *Anopheles* females lay approximately 50-200 small brown or blackish boat shaped eggs individually on the water surface (Service, 2000). Each egg has a float which consists of air filled chambers. These eggs cannot withstand desiccation. In tropical countries they hatch within 2-3 days, but in colder temperate climates hatching may not occur until after 2-3 weeks, depending on the temperature (Service, 2000). Climate preference varies between species.

There are about 430 *Anopheles* species of mosquito (Service, 2000), and each one has different biology and behaviour. Most *Anopheles* are nocturnal or crepuscular in their activities (Service, 2000). Both before and after blood feeding some species will indoors, while others will rest outdoors in natural shelters (Service, 2000). Few *Anopheles* feed exclusively on either humans or non-humans, with most feeding on both people and animals (Service, 2000).

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