

SHORT COMMUNICATION

Culicine mosquitoes (Diptera: Culicidae) attracted to humans on Espiritu Santo, Vanuatu

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In 1962 Belkin published a comprehensive monograph of the mosquitoes (Diptera: Culicidae) of the South Pacific. Additional studies on the mosquito fauna of Vanuatu (formerly the New Hebrides) have been undertaken, mainly on immature stages, by Maffi (1977, 1989), Maffi & Taylor (1977) and Taylor (1989). Fauran & Taylor (1988) surveyed two airports and their environs for adult and larval mosquitoes, and Russell (1989) collected larvae from domestic containers.

Between 24 November 1993 and 20 April 1994, mosquitoes were captured as they attempted to feed on humans at fourteen locations on Espiritu Santo. Collections were undertaken for varying periods between 17.30 and 06.30 hours and several collections were undertaken in some locations. Specimens were identified using the keys in Belkin (1962). The anopheline mosquitoes are discussed elsewhere (Williams *et al.*, 1995). In this paper we report on the culicines captured and their role in human disease transmission.

Five culicine mosquito species (728 specimens), all previously recorded from Vanuatu and known to feed on humans (Belkin, 1962; Maffi, 1977; Russell, 1989), were identified (Table 1). An additional eighty-six specimens of the *Culex* (*Culex*) *sitiens* Weidemann group could not be identified to species because of damage to diagnostic features. Many of them would be *Cx annulirostris* Skuse, the only member of the *sitiens* group identified during this study.

Culex annulirostris constituted 60% (495) of the collections. Its favoured larval habitats – ground pools with emergent vegetation – often yield high adult densities. In Australia, *Cx annulirostris* is the only known vector of the Murray Valley encephalitis virus and an important vector of Ross River virus which has occurred in epidemics in the South Pacific in the past (Lee *et al.*, 1989).

Only small numbers of the diurnally active species *Aedes* (*Stegomyia*) *aegypti* (Linnaeus) and *Ae.* (*Stg.*) *hebrideus* Edwards were captured in these largely nocturnal collections. Larvae of

both species occur in natural and artificial containers. *Ae. aegypti* is a major vector of dengue in other parts of the world and has been associated with dengue outbreaks in the Pacific (Lee *et al.*, 1987). However, other species may also be involved in transmission. Rodhain & Fauran (1975) were unable to find *Ae. aegypti* on Espiritu Santo, where over 40% of the population showed serological evidence indicative of exposure to dengue. They considered *Ae. hebrideus* to be the putative vector, a view not supported by Maffi (1977). Dengue virus has replicated in *Ae. hebrideus* in the laboratory (Rosen *et al.*, 1985), but there are still no records of natural infection. In the most recent dengue epidemic in Vanuatu, *Ae. aegypti* was found on all islands investigated (Russell, 1989), but in the absence of virus isolations from mosquitoes the significance of the individual species in transmission remains to be clarified.

Although *Aedes* (*Aedimorphus*) *nocturnus* (Theobald) and *Aedes* (*Verrallina*) *lineatus* (Taylor) feed on humans they have not been incriminated in disease transmission (Lee *et al.*, 1982, 1987). *Aedes lineatus* is well known for biting during the day but, in this study, thirty-four specimens were captured between 22.00 and 01.30 hours. The larvae of both species occur in ground-pools, often in association with each other and *Cx annulirostris*.

The anthropophilic, nocturnal species *Culex* (*Culex*) *quinquefasciatus* Say was recorded from Port Vila, Espiritu Santo, by Laveran (1902) and Buxton & Hopkins (1927) and in the larval stage by Maffi (1977), but was not detected in this survey. This is surprising, as over 80% of households have pit latrines (MoH, 1984), a major larval habitat of *Cx quinquefasciatus*. Two other anthropophilic species, *Aedes* (*Ochlerotatus*) *vigilax* (Skuse) and *Cx sitiens* Wiedemann *sensu stricto*, recorded previously in Espiritu Santo (Maffi, 1977, 1989), were absent from our collections, many of which were made within 2 km of mangrove flats, their typical breeding site.

Vanuatu is at present free of arboviruses, but future epidemics are possible due to the presence of several potential vector species of culicine mosquito. Bancroftian filariasis in Vanuatu is nocturnally periodic and transmitted by *Anopheles* (*Cellia*) *farauti* Laveran, as first investigated by Buxton & Hopkins (1927), without involvement of culicine vectors (Sasa, 1976).

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Table 1. Culicine mosquitoes attracted to humans on Espiritu Santo, Vanuatu, November 1993 to April 1994.

Place	Lat./long.	No. of hours of collection	<i>Ae. nocturnus</i>	<i>Ae. aegypti</i>	<i>Ae. hebrideus</i>	<i>Ae. lineatus</i>	<i>Cx annulirostris</i> / <i>Cx sitiens</i> group	Total
Fanafo	167°06'E, 15°24'S	46.25	26	9	5	17	140/160	217
Funafos	167°15'E, 15°34'S	4.5	2	0	0	2	12/12	16
Jaraylan	167°00'E, 15°30'S	3.5	0	0	0	0	9/9	9
Okoro	166°55'E, 15°36'S	4.0	3	0	0	0	28/48	51
Namalo	166°57'E, 15°35'S	6.5	2	0	0	0	40/43	45
Namoru	166°55'E, 15°35'S	15.5	2	0	21	21	86/104	148
Narango	166°59'E, 15°34'S	8.25	2	0	1	28	20/21	52
Nasulesule	166°54'E, 15°36'S	2.0	2	0	0	0	4/11	13
Sarete	166°58'E, 15°34'S	13.0	0	0	0	1	18/31	32
Fimele	166°57'E, 15°33'S	7.0	9	0	5	13	101/102	129
Wailapa	166°56'E, 15°35'S	13.75	11	0	2	49	31/34	96

References

- Belkin, J.N. (1962) *The Mosquitoes of the South Pacific (Diptera, Culicidae)*. Vols I and II. University of California Press, Berkeley and Los Angeles.
- Buxton, P.A. & Hopkins, G.H.E. (1927) *Researches in Polynesia and Melanesia*. Memoir No. 1, London School of Hygiene and Tropical Medicine.
- Fauran, P. & Taylor, R. (1988) Surveillance des moustiques vecteurs dans les aéroports internationaux de la région du pacifique sud. *Bulletin de la Société de Pathologie Exotique*, **81**, 125–135.
- Laveran, A. (1902) Sur des culicides des Nouvelles-Hébrides. *Comptes Rendus de la Société de Biologie*, **54**, 908–910.
- Lee, D.J., Hicks, M.M., Griffiths, M., Russell, R.C. & Marks, E.N. (1982) *The Culicidae of the Australasian Region*, Volume 2. Australian Government Publishing Service, Canberra.
- Lee, D.J., Hicks, M.M., Griffiths, M., Debenham, M.L., Bryan, J.H., Russell, R.C., Geary M. & Marks, E.N. (1987) *The Culicidae of the Australasian Region*, Volume 4. Australian Government Publishing Service, Canberra.
- Lee, D.J., Hicks, M.M., Debenham, M.L., Griffiths, M., Marks, E.N., Bryan, J.H. & Russell, R.C. (1989) *The Culicidae of the Australasian Region*, Volume 7. Australian Government Publishing Service, Canberra.
- Maffi, M. (1977) Contribution to the knowledge of the mosquito fauna of the New Hebrides island group proper (Diptera: Culicidae). *Rivista di Parassitologia*, **38**, 193–214.
- Maffi, M. (1989) The mosquitoes (Diptera, Culicidae) of Vanuatu: a further contribution. *Rivista di Parassitologia*, **51**, 3–11.
- Maffi, M. & Taylor, B. (1977) The mosquitoes of the Banks and Torres island groups of the South Pacific (Diptera: Culicidae). *Pacific Insects*, **17**, 511–522.
- MoH (1984) *Report on the maternal and child health survey of Vanuatu*. Ministry of Health, Port Vila.
- Rodhain, F. & Fauran, P. (1975) Résultats d'une enquête sur les vecteurs potentiels de la dengue aux Nouvelles Hébrides (1972 et 1974). *Bulletin de la Société de Pathologie Exotique*, **68**, 539–543.
- Sasa, M. (1976) *Human Filariasis. A Global Survey of Epidemiology and Control*. Park Press, Baltimore, and University of Tokyo Press.
- Rosen, L., Rozeboom, L.E., Gubler, D.J., Lien, J.C. & Chaniotis, B.N. (1985) Comparative susceptibility of mosquito species and strains to oral and parenteral infection with dengue and Japanese encephalitis viruses. *American Journal of Tropical Medicine and Hygiene*, **34**, 603–615.
- Russell, R.C. (1989) The distribution and abundance of *Aedes* mosquitoes in domestic container habitats in Vanuatu during an outbreak of dengue in 1989. *Arbovirus Research in Australia* (eds Uren *et al.*), pp. 206–208. CSIRO Tropical Animal Science, Brisbane.
- Taylor, B. (1989) Imago of mosquitoes collected in Vanuatu, 1987: identification and comments. *Rivista di Parassitologia*, **51**, 13–15.
- Williams, T., Maitland, K. & Foley, D.H. (1995) Malaria sporozoite rates for *Anopheles farauti* s.s. Laveran (Diptera: Culicidae) from Vanuatu. *Annals of Tropical Medicine and Parasitology*, **89**, 305–307.

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