

bancrofti primarily occurs in the hilly, forested areas in the western part of Thailand. The main vectors of *B. malayi* are *Mansonia* mosquitoes; however, some species of *Anopheles* (i.e., *An. campestris*) transmit nocturnal periodic types of the parasite (Suvannadabba, 1993). *Wuchereria bancrofti* is largely an urban and suburban disease in many parts of the world due to the habits of its principal vector *Culex quinquefasciatus* (Say); however, in Thailand the disease is primarily rural with transmission by *Anopheles* species and in some cases *Downsiomyia harinasutai* [= *Aedes (Finlaya) harinasutai*] (Knight, 1978). Harinasuta *et al.* (1971) reported that >25% of *An. maculatus*, *An. minimus*, *An. philippinensis*, *An. sinensis* (as *An. hyrcanus sinensis*), *An. stephensi*, *An. subpictus*, and *An. vagus* became infected after feeding on a patient diagnosed with a nocturnal subperiodic strain of *W. bancrofti*. However, many of the species he worked with are now considered species complexes, so precise identification is impossible. A number of other *Anopheles* species have been incriminated as vectors of filariasis (Table 2).

THE *ANOPHELES* FAUNA OF THAILAND

Harrison (1980) briefly discussed the bionomics of most of the Thai anophelines with respect to forest type. This supported the suggestion of Lekagul and McNeely (1988) that the country could be split up into six biogeographic regions. For ease of interpretation, the spatial distribution of mosquito taxa has been transferred from a biogeographical reference map onto a map that demarcates political, regional, and provincial boundaries (Fig 1). In the introduction (Section I) of this series of papers (Rattanaarithikul *et al.*, 2005) we more completely described each of these subregions. The northern (Subregion 1) and western (Subregion 2) parts of the country are in general hilly, contain high mountains, and dry evergreen forests. The *Anopheles* species in these regions, such as *An. culicifacies* (B), *An. varuna*, and *An. pseudowillmori*, are usually considered to be of Indian origin. The ranges of several of the anophelines found in these regions, such as *An. minimus s.l.* and *An. nivipes*, extend to the most southern Thai provinces and probably into southern Myanmar. The south (Subregion 3) and the primary forests of Chanthaburi and Trat (Subregion 4) contain evergreen rain forests, particularly along the Thai-Malaysia border. The ranges of a number of typically Malayan *Anopheles*, such as *An. donaldi*, *An. paraliae*, and some members of the Umbrosus Group therefore extend into Thailand. The Korat Plateau (Subregion 6) and the central valley (Subregion 5) have similar anopheline faunas. In general (except for the southern slope of the mountains found on the southern edge of the plateau), the Korat Plateau is drier than the other regions of the country. The southern slopes of the mountains in this subregion have

numerous areas of evergreen forest. The banks of the Mekong River in eastern Thailand are generally steep; however, some areas contain large areas of sandflats. A number of *Anopheles* species, to include *An. culicifacies* (B) and *An. pseudowillmori*, are found along the margins of the Mekong River. These species are usually found in flood pools, sand pools, rock pools, and temporary ground pools.

The earliest publication containing references to the anophelines of Thailand is Theobald (1910), whereas the first papers dealing specifically with the genus *Anopheles* and the role of anopheline species in the transmission of malaria in Thailand are those of Barnes (1923a,b). Barnes listed 17 species of *Anopheles* and included notes on their biology and vector relationships. The publications of Barraud and Christophers (1931), Anigstein (1932), and Causey (1937a,b) dealt with both anophelines and culicines. These papers can be important references when there is difficulty in resolving the identity of some specimens. Thurman (1959) provided a checklist of 47 species of anophelines that occurred in Thailand. Scanlon *et al.* (1968) listed 52 species of *Anopheles* known to occur in Thailand, and Harrison *et al.* (1990) listed a total of 72 species of *Anopheles*, including four unnamed species that had been confirmed using cytogenetic and molecular techniques. In this study, we report a total of 73 species of *Anopheles* (Table 3), including 71 named species, a new species near *An. gigas*, and an informally designated species, *An. minimus* C. However, 34 chromosomal forms have been recognized in 14 of the named species (Table 1) (Baimai *et al.*, 1993a,b; 1994; 1995; 1996a,b). These 34 chromosomal forms remain unnamed and require further study to determine if they are distinct species or intra-species genetic polymorphs. These forms include *An. argyropus* (A, B), *An. barbirostris* (A, B, C), *An. crawfordi* (A, B), *An. sinensis* (A, B), *An. aconitus* (A, B, C), *An. culicifacies* (A, B), *An. jamesii* (A, B), *An. jeyporiensis* (A, B, C, D), *An. karwari* (A, B, C), *An. maculatus* (E, K), *An. nigerrimus* (A, B), *An. nivipes* (A, B), *An. subpictus* (B, C, D), and *An. vagus* (A, B) (Table 1). Although 14 of these named species in Table 3 are represented by 34 chromosomal forms, the status of these forms in relation to presently named species, new sibling species or intra-species chromosomal polymorphs has not been resolved because the forms have not been compared to specimens from the type localities. Given the huge number of species and the generic diversity of mosquitoes occurring in Thailand, we feel that studies of these mosquitoes are far from complete.

Notes on habitats

In Thailand, anopheline mosquitoes occur at altitudes ranging from coastal and lowland areas of the central valley to the high mountains of the north. They are frequently