

INTRODUCTION

Keys for the identification of *Culex* mosquitoes are required for studies on the epidemiology and transmission of Japanese encephalitis (JE), an important public health problem in Thailand and Southeast Asia. Although mosquitoes of several genera have been found infected with JE virus, the majority of isolations are from species of *Culex* subgenus *Culex*, several of which are recognized as major vectors in the Oriental Region. References to *Culex* appear in scattered, out-of-date publications, eg, Barraud (1934, India) and Bram (1967, Thailand), and are not readily available or particularly useful for field entomologists and researchers. The most recent illustrated key to *Culex* in Thailand (Rattanaarithikul and Panthusiri, 1994) only includes the medically important species of subgenus *Culex*.

To assist public health workers and entomologists in the identification of fourth-instar larvae and adult females of *Culex* and *Lutzia*, keys are provided here for the species of these genera that occur in Thailand. The keys can be used to initially identify specimens to subgenus and species group, and finally to species. Differential and diagnostic characteristics are highlighted on drawings and, whenever possible, were chosen so that they could be observed using a hand lens (10x) or dissecting microscope (10-40x). Morphological terminology follows Harbach and Knight (1980, 1982). The keys are structured like those of Harbach (1985). Generic and subgeneric abbreviations are those of Reinert (2001), Tanaka (2003) and Rattanaarithikul *et al* (2005). Species author names are given in Table 1.

SYSTEMATICS

The morphological characters used here are based on original observations and previous usage in the literature. The following references were especially helpful: Barraud (1934), Belkin (1962), Bram (1967), Mattingly (1971), Sirivanakarn (1970, 1971, 1972, 1973a,b, 1976, 1977a,b,c), Harrison (1987), Tanaka *et al* (1979), Harbach and Rattanaarithikul (1988), Harbach and Mongkolpanya (1989), Tanaka (2003, 2004), and Rattanaarithikul *et al* (2005).

The majority of Oriental species of subgenus *Metalutzia* of *Lutzia* and subgenera *Culex* and *Oculeomyia* of *Culex* are very well characterized as adults by the presence of conspicuous ornamentation and features of the maxillary palpus, proboscis, thorax, legs, wings, and abdomen. In contrast, adults of subgenera *Culiciomyia*, *Eumelanomyia* and

Lophoceraomyia of *Culex* are particularly difficult to distinguish because many species lack conspicuous differences. Also, the females of most species are poorly known and not well studied.

The cibarial armature of females has been incorporated as a supplementary character, eg, (*Cx. tritaeniorhynchus*), however this structure has not so far been found to be useful in any species of *Culex*. Structures of the male genitalia are important at various levels (subgenera, groups, subgroups, and complexes), eg, phallosome, proctiger, and subapical lobe. The antennae of *Lophoceraomyia* males provide good characters but are more reliable when correlated with associated larval and/or pupal stages.

Because male genitalia, male antennae, and female cibarial armature require dissection and mounting on microscope slides, only the external characters of adult females reared from larvae or pupae are used in the keys. The immature stages show a number of specific characters that are very useful in the diagnosis of most species except those of *Lutzia* subgenus *Metalutzia*.

CULEX AND LUTZIA MOSQUITOES AS DISEASE VECTORS IN THAILAND

Japanese encephalitis

Japanese encephalitis (JE) is a serious public health problem across southern Asia, including Thailand. After the first epidemic of JE in Thailand in 1969, there were some 1,500-2,500 reported cases of viral encephalitis each year from 1970-1985 (Rojanasuphot and Tsai, 1995). Japanese encephalitis virus is maintained in nature by a complex cycle that involves pigs as amplifying hosts, bird, and mammalian reservoirs and mosquito vectors. The primary vectors of JE are various species of subgenus *Culex*. The best known and most important vectors are members of the Vishnui Subgroup, ie, *Cx. tritaeniorhynchus*, *Cx. pseudovishnui*, and *Cx. vishnui*. *Culex tritaeniorhynchus* is considered to be the principal vector of JE (Gould *et al*, 1974). *Culex gelidus* is regarded as an important vector of JE in both Malaysia and Thailand (Gould *et al*, 1962; Gingrich *et al*, 1992), and has been found naturally infected with the virus in Thailand and Vietnam (Gould *et al*, 1974; Thao *et al*, 1974). Two strains of JE virus have been isolated from *Cx. fuscocephala* in Thailand (Gould *et al*, 1974), *Cx. quinquefasciatus* has been found infected with JE virus in Vietnam (Thao *et al*, 1974), and JE virus has been isolated from *Cx. bitaeniorhynchus* and *Cx. infula* in India (Rodrigues, 1988; Samuel *et al*, 1998).