



Cytogenetics and morphotaxonomy of the *Simulium* (*Gomphostilbia*) *ceylonicum* species group (Diptera: Simuliidae) in Thailand

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Abstract

The polytene chromosomes of 1,612 larvae of three described morphospecies in the *Simulium* (*Gomphostilbia*) *ceylonicum* species group—*S. asakoeae*, *S. inthanonense*, and *S. sheilae*—were examined from 52 sites in Thailand. A standard map for the *S. ceylonicum* group was established. Ten cytoforms, plus an eleventh from the literature, are revealed on the basis of unique suites of fixed and floating inversions; sex chromosomes are microscopically undifferentiated in all cytoforms. A cytodendrogram, based on shared inversions, shows seven lineages in a polytomy derived from a hypothetical ancestor. Morphological descriptions of the known life stages of each cytoform and keys to larvae, pupae, and polytene chromosomes also are provided. Despite small sample sizes for some cytoforms, all segregates appear to be good species, supported by both chromosomal and morphological evidence. Three reproductively isolated cytoforms for which adequate material is available are formally described as new species. The existence of chromosomally distinct entities within established morphospecies of the *S. ceylonicum* group supports a recurrent trend of hidden biodiversity in South-east Asian black flies. The differentiation of taxa that we found in the *S. ceylonicum* group between northern and southern Thailand conforms to a similar biogeographic trend in diverse organisms.

Key words: *Simulium ceylonicum* group, aquatic insects, black flies, new species, polytene chromosomes, Thailand

Introduction

The taxonomy of black flies has been studied extensively in many countries of the world, making the Simuliidae one of the best-known families of aquatic insects at the species level. In North America, for example, 98% and 93% of the species are known as larvae and pupae, respectively (Adler *et al.* 2004). In Thailand, morphotaxonomy has been the focus of most simuliid studies (e.g., Takaoka and Kuvangkadilok 1999; Kuvangkadilok and Takaoka 2000; Takaoka and Choochote 2004; Takaoka and Choochote 2005; Takaoka and Choochote 2006), with some cytotaxonomic works (Kuvangkadilok *et al.* 1999a, b; Kuvangkadilok *et al.* 2003; Phasuk *et al.* 2005) and a few molecular studies (Pramual *et al.* 2005; Thanwisai *et al.* 2006). A total of 71 species of black flies in the following six subgenera have been recorded from Thailand: *Asiosimulium* Takaoka and Choochote, *Daviesellum* Takaoka and Adler, *Gomphostilbia* Enderlein, *Montisimulium* Rubtsov, *Nevermannia* Enderlein, and *Simulium* Latreille, with *Simulium* the largest subgenus, followed by *Gomphos-*