



## ***Bothaella manhi*, a new species of tribe Aedini (Diptera: Culicidae) from the Cuc Phuong National Park of Vietnam based on morphology and DNA sequence**

SHELLEY COOK<sup>1</sup>, NGO GIANG LIEN<sup>2</sup>, ERICA MCALISTER<sup>1</sup> & RALPH E. HARBACH<sup>1</sup>

<sup>1</sup>Department of Entomology, The Natural History Museum, Cromwell Road, London SW7 5BD, U.K.

E-mail: s.cook@nhm.ac.uk, e.mcalister@nhm.ac.uk, r.harbach@nhm.ac.uk

<sup>2</sup>Department of Cell Biology, Hanoi University of Science, 334 Nguyen Trai Road, Hanoi, Vietnam. E-mail: ngogianglien@hus.edu.vn

### **Abstract**

A new species of genus *Bothaella* (Diptera: Culicidae) collected along with two other species of the genus during surveys for flavivirus isolations in the Cuc Phuong National Park in northern Vietnam is formally described and named as *Bothaella manhi*, **sp. n.** The adults, pupa and fourth-instar larva are characterized, the male genitalia and the two immature stages are illustrated and DNA sequence data are included for regions coding for sections of the COI and COII genes (mtDNA). The species is compared and distinguished from the other species of the genus, and sequence data are used to hypothesise its phylogenetic relationship with *Bo. helenae* and *Bo. kleini*, the other two species collected during the survey.

**Key words:** *Bothaella alongi*, *Bothaella helenae*, *Bothaella kleini*, COI, COII, mosquito, new species, taxonomy

### **Introduction**

*Bothaella* Reinert, 1973 is a little-known genus of mosquitoes (Diptera: Culicidae) that includes five species in Southeast Asia: *Bo. alongi* (Galliard & Ngu, 1947), *Bo. brownscutuma* (Dong, Zhou & Dong, 1999), *Bo. eldridgei* (Reinert, 1973), *Bo. helenae* (Reinert, 1973) and *Bo. kleini* (Reinert, 1973). Two of these species, *Bo. helenae* and *Bo. kleini*, and an unidentifiable species were found among adult mosquitoes collected in the Cuc Phuong National Park of Ninh Binh Province in northern Vietnam for flavivirus screening in August 2008. Additional specimens of *Bo. helenae* and the unidentifiable species were subsequently found in a collection of individually reared mosquitoes made in the park in July 2000. Dissection of the male genitalia confirmed that the unidentifiable species is distinct from *Bo. brownscutuma*, *Bo. eldridgei*, *Bo. helenae* and *Bo. kleini*, and a critical comparison of specimens with the detailed descriptions of the female and larva of *Bo. alongi* (Reinert *et al.*, 2006), the male of which is unknown, revealed it is distinct from that species as well. Based on these findings, the species is formally described and named as new in this paper. Sequence data for regions coding for sections of the COI and COII genes of mitochondrial DNA were obtained from specimens of the new species, *Bo. helenae* and *Bo. kleini* and used to hypothesise their phylogenetic relationships.

### **Material and methods**

This study is based on wild-caught adults (vouchers of mosquitoes used for flavivirus screening) and adults reared from larvae and/or pupae collected in the Cuc Phuong National Park, Ninh Binh Province, northern Vietnam.

**Morphology.** Observations of adult mosquitoes were made under simulated natural light. Larval and pupal chaetotaxy were studied using differential interference contrast microscopy. Numbers in parentheses represent modes, when apparent, of the recorded ranges. The morphological terminology and abbreviations