

## Spread of the West Nile virus vector *Culex modestus* and the potential malaria vector *Anopheles hyrcanus* in central Europe

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**ABSTRACT:** Mosquito faunal studies were carried out in five separate wetland regions in the Czech Republic during 2004–2007, sampling with dry ice-baited and sentinel host-baited CDC traps. A total of 79,245 adults was identified, representing 23 mosquito species that belonged to the genera *Anopheles*, *Culiseta*, *Coquillettidia*, *Aedes*, and *Culex*. Our findings reveal that the mosquito fauna is enriched by new elements in the Mediterranean region. Historical and CDC trap data suggest that the newly-emerging potential malaria vector, *Anopheles hyrcanus*, has reached the northern limit of its distribution in the Czech Republic, and the important West Nile virus (WNV) vector, *Culex modestus*, has widened its distribution in the Czech Republic. No significant differences were observed in a total number of mosquitoes collected by traps baited with either the sentinel animals or with CO<sub>2</sub>, although species abundance differed. A relatively higher proportion of *Cx. modestus* was collected in the sentinel-baited traps, while the proportion of *Cx. pipiens* was higher in the CO<sub>2</sub>-baited traps. *Journal of Vector Ecology* 33 (2): 269–277. 2008.

**Keyword Index:** Mosquitoes, WNV, Czech Republic, climate change.

### INTRODUCTION

In recent years, several vector-borne diseases affecting both humans and domestic animals have re-emerged and spread in Europe with major health, ecological, socio-economical, and political consequences (Reiter 2001, Gubler 2002, Zell 2004, Rogers and Randolph 2006). Despite a temperate climate and high economic and hygiene standards, several mosquito-borne viruses appear to circulate in Central Europe (Hubálek and Halouzka 1996, 1999). Serological surveys and viral isolates from mosquitoes indicate that Sindbis (SINV), West Nile virus (WNV), Usutu virus (USUV), and partially Batai virus (BATV) are widespread and probably enzootic in many countries of the region (Hubálek and Halouzka 1996, Gratz 2004, Hubálek et al. 2005). WNV has emerged and re-emerged as has also been demonstrated in the United States (Garmendia et al. 2001). During the past 40 years, human and equine outbreaks of WNV were reported from many European countries, and human cases of West Nile fever also occurred in the Czech Republic (southern Moravia) in July 1997, after heavy rains caused extensive flooding along the Morava River (Hubálek and Halouzka 1999). Based on the abundance, feeding behavior, previous WNV isolations, and recent experimental transmission, several mosquito species were implicated as the main WNV vectors in the European WNV outbreak, including *Culex pipiens*, *Cx. modestus*, and *Coquillettidia richiardii* (Hubálek and Halouzka 1999, Balenghien et al. 2006).

Mosquito abundance is monitored world-wide and these insects serve as a suitable group for studying changes caused by trends in environmental conditions (e.g., Hemmerter et

al. 2007). These types of studies were undertaken by several authors within the Czech and Slovak Republics. Since 1958, mosquito distribution was determined in just a few localities (Kramář 1958, Minář and Halgoš 1997, Országh et al. 2006). So far, 42 mosquito species have been recorded in the Czech Republic (37 in Bohemia and 37 in Moravia) (Országh et al. 2006), with some of them considered as rare (e.g., vectors of WNV – *Cx. modestus* and *Cq. richiardii* in Bohemia). However, species composition is not stable in time, and climate change during recent years resulted in several new records of Mediterranean mosquito species in Slovak territory, including *Culex theileri* (Halgoš and Petrus 1996) and *Anopheles hyrcanus* (Halgoš and Benková 2004). Both of these species are currently absent in the Czech Republic. Similarly in southern Moravia, two new thermophilic species were recorded during the last three decades: *Culex martinii* and *Uranotaenia unguiculata* (Vaňhara 1981; Minář and Halgoš 1997).

Our mosquito surveillance program focused on the distribution, vector capacity, and feeding behavior of mosquitoes with the following goals: 1) to monitor mosquito populations and changes in species composition over time at several localities in the Czech Republic (Bohemia and Moravia), 2) to detect feeding preferences and behavior as well as spatial distribution of the mosquito species involved in WNV transmission, and 3) to test the mosquitoes and wild and domestic birds for WNV in order to identify possible disease foci. In the present article, we provide a report on the first objective.