DOI: 10.2478/s11686-013-0158-2

Acta Parasitologica, 2013, 58(4), 603–606; ISSN 1230-2821

VERSITA

RESEARCH NOTE

First record of *Aedes albopictus* in Slovakia

Eva Bocková, Alica Kočišová* and Valéria Letková

Institute of Parasitology, University of Veterinary Medicine and Pharmacy in Košice, Komenského 73, 041 81 Košice, Slovak Republic

Abstract

During a routine inspection of the mosquito fauna in the Košická Basin (Eastern Slovakia), in one of the monitored locations we have caught 4 females of the invasive mosquito *Aedes albopictus*, using the CO_2 baited CDC traps. Occurrence of this particular mosquito has already been reported in many European countries; in Slovakia, however, this is the first finding ever. The finding of *Ae. albopictus* extends the list of the mosquito fauna in Slovakia to 50 species and Slovakia thus ranks among other 20 European countries where this mosquito was observed. The presence of *Ae. albopictus* increased the probability of transmission of canine and human dirofilariosis in urban environment.

Keywords

Aedes albopictus, Košická Basin, Slovakia

The original territory of *Aedes albopictus* mosquito occurrence included tropical and subtropical regions of the south-east Asia, from where it spread to other parts of the world. As early as in 1967 it was found only in the mentioned parts of Asia, in India, and few Pacific locations. Since then, however, it has rapidly spread to Northern and Southern America, Africa, Caribbean, Middle East, Australia, and Europe. The first record on its occurrence in Europe comes from Albania in 1970 (Adhami and Reiter 1998) and since then every year new information appears about its occurrence also in other European countries, e.g. Italy, France, Belgium, Switzerland, Serbia, Montenegro, Bosnia and Herzegovina, Germany, Holland, Bulgaria, Slovenia, Croatia, Greece, Malta, Vatican, Monaco, San Marino, Spain, the Czech Republic and Austria.

Aedes albopictus shows a wide genetic and physiological variability, and its remarkable ecological flexibility and adaptability contributes significantly to colonization of new natural as well as artificial locations. A typical method of dispersal of this invasive mosquito to long distances is transportation of preimaginal stages, especially dry-resistant eggs, inside the used tyres (Knudsen 1995) and import of the ornamental plant *Dracaena* spp. (called also a „lucky bamboo“) (Madon *et al*. 2002) from China by international freight. In Europe, the most important method of passive spread of this mosquito is the lorry transport of goods from Southern Europe (Werner *et al*. 2011). The rate of spread, not only in Europe, is directly related to increasing rate of international transport. In the last 20 years, *Aedes albopictus* has become one of fastest spreading animals in the world (Benedict *et al*. 2007). The Global Invasive Species Database classifies this mosquito as one of 100 most invasive species.

Under natural conditions, *Ae. albopictus* is capable of transmitting 3 Flaviviruses (Dengue, West Nile, and Japanese Encephalitis), 6 Bunyaviruses (Jamestown Canyon, Keystone, LaCrosse, Potosi, Cache Valley, and Tensaw), and 1 Alphavirus (Eastern Equine Encephalitis). Transmission of at least 22 other arboviruses was confirmed experimentally (Mitchell 1995, Gratz 2004). *Aedes albopictus* is also an important vector of *Dirofilaria* spp. (Cancrini *et al*. 2003a,b). A characteristic feature of this species is a wide range of hosts, from amphibians through reptiles, birds, and mammals, including humans (Eritja *et al*. 2005). This wide host specificity provides a significant advantage compared to *Ae. aegypti*, the primary and the most important vector of Dengue and Yellow Fever viruses (Christophers 1960). Global expansion of *Ae. albopictus* over the last 30 years resulted in increasing interest in protection of public health, preventive measures against its further spreading and in an effort to monitor this mosquito

*Corresponding author: kocisova@uvlf.sk

Fig. 1. *Aedes albopictus* female

more thoroughly. Successful spreading and adaptation of this insect to the new environment was facilitated significantly by global and local climate changes.

We carried out mosquito research in the Košická Basin (Eastern Slovakia) since 2010, primarily in inundated areas along the rivers or water resources (e.g. drainage canals). At these locations our recent research has proved the presence of 16 larval types (Bocková and Kočišová 2012) and 17 species of adult mosquitoes. The Košická Basin, especially its rural zones, is characterized by agricultural activities, livestock breeding, and keeping farm animals and pets. From the climate point of view, the whole Basin belongs to the areas with the climate and climatic factors (temperature, rainfall) favourable for breeding of mosquitoes. The average annual temperature of 8–10°C together with the average annual rainfall of 500–850 mm provides ideal conditions for mosquito development. Animal breeding and the forest coverage provide a wide range and sufficient number of potential hosts for mosquito females. We collected the larvae using a standard sieve method (Kramář 1958); adults were collected by light CDC traps with CO_2 bait. During the routine field trapping (23th July 2012) at the monitored location (wind barrier) in Šebastovce village, we have caught not only mosquitoes *Aedes cinereus*, *Aedes vexans*, *Anopheles maculipennis*, *Ochlerotatus sticticus,* and *Culex pipiens,* but also 4 *Aedes albopictus* females (Fig. 1) which were diagnosed on the basis of morphological signs. During the entire season, the traps were placed in the area of mostly poplar-tree wind-barrier, in

the middle of which there is a drain canal collecting water from adjacent agrocenoses. A clay-foliate canal bed and a rich root system of the surrounding wood vegetation are capable of maintaining rain water and high environment humidity for a long time. Distribution and survival of *Ae. albopictus* is most significantly affected by 3 environmental factors – winter and summer temperatures, photoperiod, and volume of rainfall. The most critical stage of successful hibernation of eggs is during winter months (especially in January). The threshold value of egg survival is 0°C; with the falling temperature the success rate significantly rises. For adults' survival and successful life cycle, average environment temperatures around 11°C are sufficient. The monitored location meets these threshold ecological requirements and, moreover, it is characteristic with slightly higher volume of rainfall than in the neighbouring areas. Spread of this mosquito is also significantly influenced by the method of land utilization, method of urbanization, population density, etc. The Šebastovce village [+48°39′14.68″N, +21°16′4.70″E] is located at the periphery of Košice, 209 metres above the sea level. In the north and east it borders the Košice-Barca municipal district, cadastral area of which includes also the Košice international airport; in the south it borders villages Haniska and Valaliky (Fig. 2).

Along the marginal zone of the village there is a motorway circuit heading to the border with Hungary, used especially for the international lorry transport and tourism during summer. With regard to the above mentioned facts, the possibility of *Ae. albopictus* spread particularly to this territory was and still is significantly high. Despite the fact that the most important method of passive spread of this invasive mosquito in Europe is regarded to be the lorry transport, it is advisable not to underestimate the possibility of adult stages spread by the means of air transport.

Eastern Slovakia, including the Košická Basin, is one of very favourable areas for the mosquito development. Due to the nature of the country, warm climate, and sufficient annual rainfall this territory has already proved in the past to be the place suitable not only for mosquitoes as such, but also for causal agents of the diseases they are able to transmit. In the fifties of the past century, the entire area was an endemic area of malaria. At present, ideal environmental conditions in concurrence with the persistent and increasing trend of livestock keeping result in the spread of the disease untypical for this climate zone – dirofilariasis of carnivores, especially dogs and foxes.

Continental location of Slovakia in the middle of Europe enables contacts with the neighbouring countries and facili-

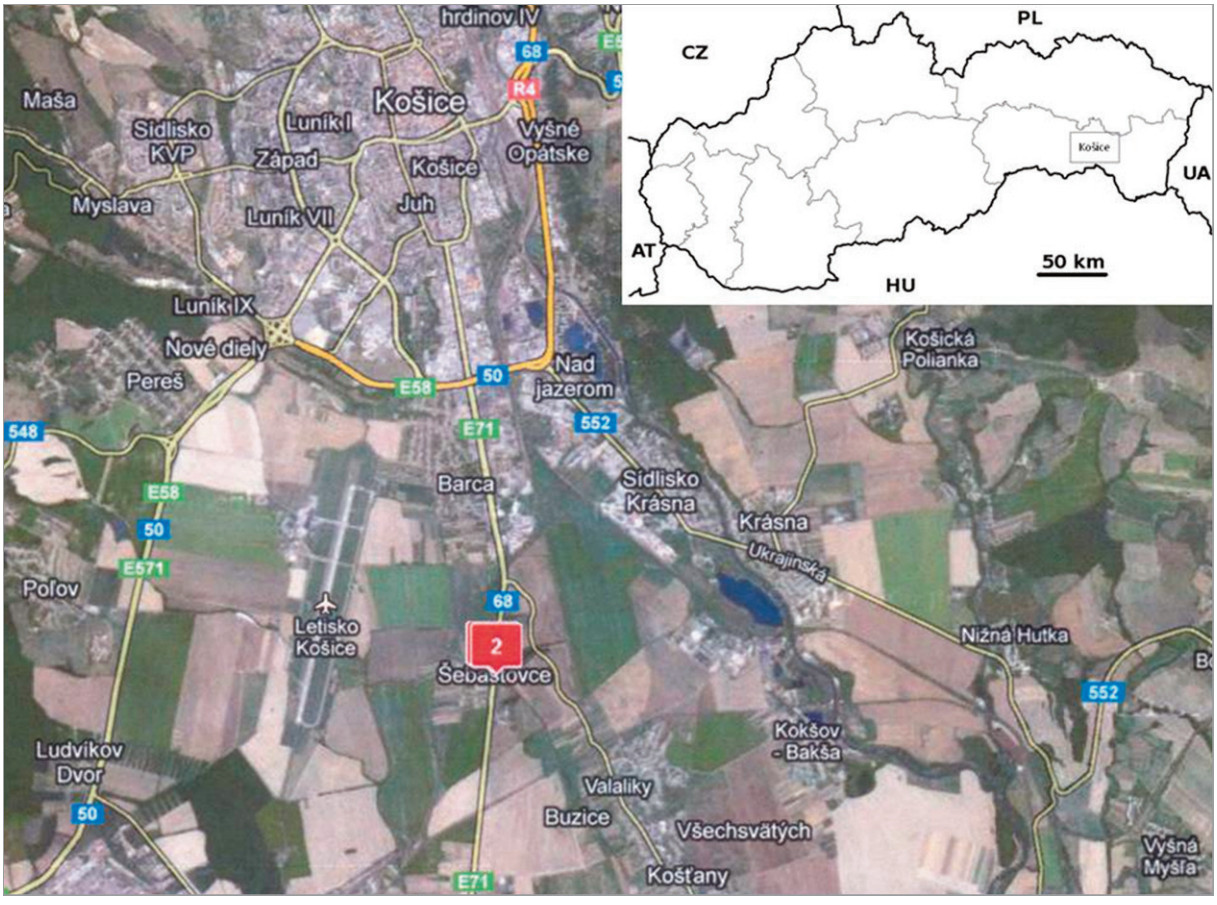

Fig. 2. Map of Slovakia showing the first record of *Aedes albopictus* (Šebastovce – 2)

tates the transit transport from other countries across this territory, which compensates to certain extent the disadvantage of the sea transport absence. However, the distances to the nearest ports (550–850 km) do not present any serious problems, so there are no constraints on potential invasive mosquito species spreading or risk of causal agents of many diseases in Slovakia. Of the central European countries in close proximity to Slovakia, the finding of *Ae. albopictus* was reported in Southern Moravia (Czech Republic) (Šebesta *et al*. 2012) and actually from Austria (Seidel *et al*. 2013).

Acknowledgements. We would like to express our gratitude to Dr. Oldřich Šebesta and Dr. Francis Schaffner for their assistance in verification of *Ae. albopictus* species identity. This study was financed and executed within the grant VEGA No. 1/0236/12 and primary research of the National Reference Laboratory for Pesticides of the University of Veterinary Medicine and Pharmacy in Košice.

References

Adhami J., Reiter P. 1998. Introduction and establishment of *Aedes* (*Stegomyia*) *albopictus* Skuse (Diptera: Culicidae) in Albania. *Journal of the American Mosquito Control Association*, 14, 340–343.

Benedict M.Q., Levine R.S., Hawley W.A., Lounibos L.P. 2007. Spread of the tiger: global risk of invasion by the mosquito *Aedes albopictus*. *Vector Borne Zoonotic Diseases*, 7, 76–85.

Bocková E., Kočišová A. 2012. Species composition, seasonal dynamics, distribution and density of mosquito larvae in Košice basin in the years 2010 and 2011 (In Slovak). In: *Proceedings "Xth Czech and Slovak Parasitological days 2012", 28 May-1 June, 2012 Brno, Czech Republic*, 35.

Cancrini G., Frangipane di Regalbono A., Ricci I., Tessarin C., Gabrielli S., Pietrobelli M. 2003a. *Aedes albopictus* is a natural vector of *Dirofilaria immitis* in Italy. *Veterinary Parasitology*, 118, 195–202.

Cancrini G., Romi R., Gabrielli S., Toma L., Di Paolo M., Scaramozzino P. 2003b. First finding of *Dirofilaria repens* in a natural population of *Aedes albopictus*. *Medical and Veterinary Entomology*, 17, 448–451.

Christophers S.R. 1960. *Aedes aegypti (L), the yellow fever mosquito*. Its life history, bionomics, and structure. Cambridge University Press, 739 pp.

Eritja R., Escosa R., Lucientes J., Marque`s E., Molina R., Roiz D., Ruiz S. 2005. Worldwide invasion of vector mosquitoes: present European distribution and challenges for Spain. *Biological Invasion*, 7, 87–97.

Gratz N.G. 2004. Critical review of the vector status of *Aedes albopictus*. *Medical and Veterinary Entomology*, 18, 215–227.

Kramář J. 1958. Biting mosquitoes – Culicinae (In Czech). Fauna ČSR Nakladatelství Československé akademie věd Praha, 425 pp.

Knudsen A.B. 1995. Global distribution and continuing spread of *Aedes albopictus*. *Parassitologia*, 37, 91–97.

Madon M., Mulla M.S., Shaw M.W., Kluh S., Hazelrigg J.E. 2002. Introduction of *Aedes albopictus* (Skuse) in Southern California and potential for its establishment. *Journal of Vector Ecology*, 27, 149–154.

Mitchell C.J. 1995. The role of *Aedes albopictus* as an arbovirus vector. *Parassitologia*, 37, 109–113.

Seidel B., Kolodziejek J., Indra A., Hufnagl P., Brugger K., Schaffner F., Allerberger F., Nowotny N. 2013. Emergence of the Asian tiger mosquito *Aedes* (*Stegomyia*) *albopictus* in two geographically separated Austrian provinces, May and September 2012. Vector and Parasites, *in press*.

Šebesta O., Rudolf I., Betášová L., Peško J., Hubálek Z. 2012. An invasive mosquito species *Aedes albopictus* found in the Czech Republic, 2012. http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=20301.

Werner D., Kronefeld M., Schaffner F., Kampen H. 2011. Two invasive mosquito species, *Aedes albopictus* and *Aedes japonicus japonicus*, trapped in south-west germany, July to August 2011. http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=2.

(Accepted: June 27, 2013)