

SHORT COMMUNICATION

## First record and establishment of the mosquito *Aedes albopictus* in Spain

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**Abstract.** The invasive mosquito *Aedes (Stegomyia) albopictus* (Skuse) (Diptera: Culicidae) was detected for the first time in Spain, in Sant Cugat del Vallès, a city in the north-east of the country (41°28' N, 2°4' E, altitude 120 m), during August 2004. A male and one larva were collected in the backyard of a house and in a tree hole, respectively. Dense populations of adults and larvae were found in subsequent surveys, confirming the establishment of the species in the area. This is the first report of the establishment of this species in the Iberian Peninsula.

**Key words.** *Aedes albopictus*, exotic, invasive, Spain.

Native to the Oriental Region (Hawley, 1988), the so-called 'tiger mosquito', *Aedes albopictus* (Skuse), has been reported in more than 25 countries on the five continents outside its natural region since the end of the 1970s, and is an important vector of several arboviruses, including dengue, yellow fever and diverse types of encephalitis (Mitchell, 1995; Gratz, 2004). *Aedes albopictus* is a competent laboratory vector of at least 23 arboviruses and also of *Dirofilaria* species (Mitchell, 1995), with an important role as a rural vector of dengue (Gratz, 2004). In the U.S.A. and Italy, countries where this mosquito has been established for more than a decade, transmission of viruses to humans has not been proven (Romi, 2001), although viruses such as West Nile, La Crosse and eastern equine encephalitis have been detected in this species in the U.S.A. (Holick *et al.*, 2002; Gratz, 2004). In both countries, *Dirofilaria* species have been detected in this mosquito (Cancrini *et al.*, 2003; Comiskey & Wesson, 1995). These canine nematodes, which can affect humans, are also present in Spain (Simon *et al.*, 1996; Aranda *et al.*, 1998).

The usual means of dispersal of this invasive species is the transport of eggs in used tyres (Knudsen, 1995), although international trade of the decorative plant, Lucky Bamboo (*Dracaena* spp.), has also been implicated (Madon *et al.*, 2002).

The first modern establishment outside its original range was reported in 1979 in Albania (Adhami & Murati 1987, cited by Adhami & Reiter, 1998). In the Americas, the first established population of *Aedes albopictus* was detected in

1985, in Texas, U.S.A. (Sprenger & Wuithiranyagool, 1986). Adaptation to cold suggested that the strain probably came from a non-tropical area of Asia, as was confirmed by specimen detection in tyres coming from Japan (Reiter, 1998). *Aedes albopictus* reached Brazil in 1986, Mexico two years later and many countries of Central and South America thereafter (Rossi *et al.*, 1999). In Africa, the species was detected in South Africa in 1990 (Cornel & Hunt, 1991) and found to be established in Nigeria, Cameroon (Fontenille & Toto, 2001) and Equatorial Guinea (Toto *et al.*, 2003). In Europe, following detection in Albania as early as 1979, the species was reported in Italy in 1991 as a large population near Padua (Dalla Pozza & Majori, 1992), with invasion of other regions of that country in subsequent years (Romi, 2001). Established populations of *Aedes albopictus* were found in two tyre dumps in France in 1999 (Schaffner & Karch, 2000), but both were apparently eradicated by chemical control actions in 2001 (Schaffner, 2002). Belgium was highlighted in 2000 as the fourth European country to prove positive (Schaffner *et al.*, 2004). The species was recently reported from Serbia and Montenegro (Petric *et al.*, 2001), Israel (Pener *et al.*, 2003), Switzerland (Flacio *et al.*, 2004) and Greece (Samanidou *et al.*, 2005). In recent decades, several authors have pointed out that *Aedes albopictus* may have colonized more regions in southern Europe, emphasizing the importance of establishing systems of detection of imported vectors (Knudsen, 1995; Gratz, 2004). The Spanish arbovirus and arthropod

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surveillance network, EVITAR, has developed a monitoring system in response to the perceived risk situation in the country (Eritja *et al.*, 2005). Surveillance in used-tyre storage facilities during 2003 and 2004, did not reveal any exotic mosquito species.

On August 9, 2004, continuous complaints about the presence of black flies in the city of Sant Cugat del Vallès led the Mosquito Control Service (MCS) of the Baix Llobregat Council to survey the area. Sant Cugat del Vallès (41°28' N, 2°4' E, altitude 120 m) is a residential area with more than 70 000 inhabitants, located in the county of Vallès Occidental. The city is 15 km north-east of Barcelona, the capital of Catalonia, and has a Mediterranean climate with annual average minimum temperatures of 10.2°C and average annual rainfall of 605 mm. During inspections of possible black-fly breeding sites, some mosquito habitats were also sampled. One male mosquito was collected in a house and some mosquito larvae were detected in neighbouring tree holes. In the laboratory, the male and another male that emerged from the larvae collections were identified as *Aedes albopictus*. The remaining larvae were identified as *Culex pipiens* (L.) and *Culiseta longiareolata* (Macquart). On subsequent days, more larvae of *Aedes albopictus* were found in nearby locations, confirming the evidence of an introduction of this species. Later surveys detected adult females, males or immature stages in a wide range of habitats (tyres, small containers, forest areas and parks) throughout the city, showing the establishment of this exotic species in the region. A significant loss in the quality of life in the local community was evidently due to the activity of this mosquito, as has happened in other areas invaded by *Aedes albopictus* (Romi, 2001). Finally, interviews with citizens, local authorities, medical services and consequent inspections indicated that this species had been present in the area for at least two years. Interestingly, no used-tyre dumps or plant nurseries were found associated with the presence of *Aedes albopictus* in the area. Voucher specimens have been deposited in the MCS collection at El Prat de Llobregat, Barcelona, Spain.

The Iberian Peninsula is considered a suitable area for the development of some arthropod borne viruses and evidence of their presence has been reported (Lozano & Filipe, 1986; Filipe & Andrade, 1990). The EVITAR network is at present evaluating the extent and origin of this introduction and cooperates with competent authorities to establish efficient control strategies. Prevention of dispersion of this species to the rest of Spain and Portugal will reduce possible health risks and guard against the high cost of control measures.

This introduction is the first to be reported in the Iberian Peninsula and it is also the first time that an exotic mosquito species has been detected and found to be established in recent times in Spain. It does not seem to be associated with the storage of used tyres or the transport of Lucky Bamboo, the usual means of transportation of immature stages (Knudsen, 1995; Madon *et al.*, 2002). Other possible means of dispersal include transportation of adult

mosquitoes in cars or lorries, although this has not been investigated. There are two major motorways, however, in the area of the infestation.

We consider these data to be of value to research on new means of dispersal and to the development of strategies of detection in threatened areas.

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## 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.
- Aranda, C., Panyella, O., Eritja, R. & Castella, J. (1998) Canine filariasis. Importance and transmission in the Baix Llobregat area, Barcelona (Spain). *Veterinary Parasitology*, **77**, 267–275.
- Cancrini, G., Frangipane di Regalbono, A.F., Ricci, I., Tessarin, C., Gabrielli, S. & Pietrobelli, M. (2003) *Aedes albopictus* is a natural vector of *Dirofilaria immitis* in Italy. *Veterinary Parasitology*, **118**, 195–202.
- Comiskey, N. & Wesson, D.M. (1995) *Dirofilaria* (Filarioidea: Onchocercidae) infection in *Aedes albopictus* (Diptera: Culicidae) collected in Louisiana. *Journal of Medical Entomology*, **32**, 734–737.
- Cornel, A.J. & Hunt, R.H. (1991) *Aedes albopictus* in Africa? First records of live specimens in imported tires in Capetown. *Journal of the American Mosquito Control Association*, **7**, 107–108.
- Dalla Pozza, G. & Majori, G. (1992) First record of *Aedes albopictus* establishment in Italy. *Journal of the American Mosquito Control Association*, **8**, 318–320.
- Eritja, R., Escosa, R., Lucientes, J., Marquès, E., Molina, R., Roiz, D. & Ruiz, S. (2005) Worldwide invasion of vector mosquitoes: present European distribution and challenges for Spain. *Biological Invasions*, **7**, 87–97.
- Filipe, A.R. & Andrade, H.R. (1990) Arboviruses in the Iberian Peninsula. *Acta Virologica*, **34**, 582–591.
- Flacio, E., Lüthy, P., Patocchi, N., Guidotti, F., Tonolla, M. & Peduzzi, R. (2004) Primo ritrovamento di *Aedes albopictus* in Svizzera. *Bollettino della Società Ticinese di Scienze Naturali*, **92**, 141–142.
- Fontenille, D. & Toto, J.C. (2001) *Aedes (Stegomyia) albopictus* (Skuse), a potential new Dengue vector in Southern Cameroon. *Emerging Infectious Diseases*, **7**, 1066–1067.
- Gratz, N.G. (2004) Critical review of the vector status of *Aedes albopictus*. *Medical and Veterinary Entomology*, **18**, 215–227.
- Hawley, W.A. (1988) The Biology of *Aedes albopictus*. *Journal of the American Mosquito Control Association*, **4**, 1–39.
- Holick, J., Kyle, A., Ferraro, W., Delaney, R.R. & Iwaseczko, M. (2002) Discovery of *Aedes albopictus* infected with West Nile virus in south eastern Pennsylvania. *Journal of the American Mosquito Control Association*, **18**, 131.

- Knudsen, A.B. (1995) Global distribution and continuing spread of *Aedes albopictus*. *Parassitologia*, **37**, 91–97.
- Lozano, A. & Filipe, A.R. (1986) Antibodies against the West Nile virus and other arthropod-transmitted viruses in the Ebro Delta region. *Revista Española de Salud Pública*, **72**, 245–250.
- 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.
- Pener, H., Wilamowski, A., Schnur, H., Orshan, L., Shalom, U. & Bear, A. (2003) *Aedes albopictus* in Israel. *European Mosquito Bulletin*, **14**, 32.
- Petric, D., Pajovic, I., Ignjatovic Cupina, A. & Zgomba, M. (2001) *Aedes albopictus* (Skuse, 1894) new mosquito species (Diptera, Culicidae) in entomofauna of Yugoslavia. *Symposia of the entomologists of Serbia*, Entomological Society of Serbia, Belgrade, Serbia and Montenegro, Goc, pp. 26–29.
- Reiter, P. (1998) *Aedes albopictus* and the world trade in used tires, 1988–1995: the shape of the things to come? *Journal of the American Mosquito Control Association*, **14**, 83–94.
- Romi, R. (2001) *Aedes albopictus* in Italia: un problema sanitario sottovalutato. *Annali dell'Istituto Superiore di Sanità*, **37**, 241–247.
- Rossi, G., Pascual, N. & Krsticevic, F. (1999) First Record of *Aedes albopictus* (Skuse) from Argentina. *Journal of the American Mosquito Association*, **15**, 422–422.
- Samanidou-Voyadjoglou, A., Patsoula, E., Spanakos, G. & Vakalis, N.C. (2005) Confirmation of *Aedes albopictus* (Skuse) (Diptera: Culicidae) in Greece. *European Mosquito Bulletin*, **19**, 10–12.
- Schaffner, F. (2002) *Rapport scientifique des opérations de surveillance et de traitement d'Aedes albopictus et autres espèces exotiques importées*. Internal administrative report, EID Méditerranée – ADEGE, Montpellier, France.
- Schaffner, F. & Karch, S. (2000) Première observation d'*Aedes albopictus* (Skuse, 1894) en France métropolitaine. *Comptes Rendus de l'Académie des Sciences, Paris, Sciences de la Vie*, **323**, 373–375.
- Schaffner, F., Van Bortel, W. & Coosemans, M. (2004) First record of *Aedes (Stegomyia) albopictus* in Belgium. *Journal of the American Mosquito Control Association*, **20**, 201–203.
- Simon, F., Cordero, M., Muro, A., Perera, L., Espinoza, E. & Santamaria, B. (1996) Public health problems due to *Dirofilaria*: the Spanish situation. *Veterinary Research Communications*, **20**, 340–344.
- Sprenger, D. & Wuithiranyagool, T. (1986) The discovery and distribution of *Aedes albopictus* in Harris County, Texas. *Journal of the American Mosquito Control Association*, **2**, 217–219.
- Toto, J.C., Abaga, S., Carnevale, P. & Simard, F. (2003) First report of the oriental mosquito *Aedes albopictus* on the West African island of Bioko, Equatorial Guinea. *Medical and Veterinary Entomology*, **17**, 343–346.

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