

Aedes albopictus (Skuse, 1894) established in metropolitan France

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Abstract

The first observations of *Aedes albopictus* in metropolitan France are reported from localities in the Orne (Basse-Normandie) and Vienne (Poitou-Charentes) départements. Larvae, pupae and adults were collected between October 12th and 29th 1999 in used-tyre storage centres. The tyre recycling company imports numerous tyres from the USA, Italy and Japan. Reproduction of the species has certainly taken place in France, and the environmental conditions make the establishment of the species possible.

Native to south-east Asia and the Indian Ocean, the “tiger mosquito”, *Aedes (Stegomyia) albopictus* (Skuse), has been spreading throughout the world since the end of the 1970s. The main means of dispersion of *Ae. albopictus* is as eggs or larvae in used tyres. When these tyres are stored outside, they collect rainwater and organic matter e.g. dead leaves, and provide breeding sites for some species of Culicidae. *Ae. albopictus*, which normally breeds in tree holes, has easily adapted to these artificial breeding sites. Eggs are laid on the inside surface of the tyre and are carried across the world through used-tyre commercial exchanges. The species is now recorded in many countries of the Americas, Africa and Oceania. In Europe it was recorded in Albania (1979) and Italy (1990) where it is now widely established (Adhami & Reiter, 1998; Romi *et al.*, 1999) and, most recently, in France (Schaffner & Karch, 2000).

Aedes albopictus is an important vector of dengue and other arboviruses, as well as filaria, in Asia. In Europe apart from the biting nuisance, there is a risk of transmission to humans and animals of *Dirofilaria* and arboviruses such as Sindbis, Tahyna and West Nile (Mitchell, 1995; Guillet & Nathan, 1999). Furthermore the increasing mobility of people between dengue endemic and dengue-free areas increases the risk of transmission in those areas to which this proven vector spreads. It must be recalled that the largest dengue epidemic occurred in Greece in 1927–1928, with over a million cases and more than 1500 deaths (Cardamatis, 1929).

Aware of the sanitary risk (Rodhain, 1993), the French Ministry of Health requested the ADEGE* in April 1998 to set up a supervising committee, which included the IRD (ex-Orstom), the Institut Pasteur de Paris and the Centre Hospitalier Universitaire de Nice. Due to the extension of the species distribution in Italy, several preliminary surveys were carried out over the past years to detect the possible presence of the species along the French Mediterranean coast (Fauran *et al.*, 1998). In 1999, the next step was to visit the main French centres storing imported used-tyres from the USA, Japan or Italy (countries known to be breeding areas for *Ae. albopictus*). These centres deal with tyres for trucks, heavy vehicles and aircraft and are resold either directly or after being recapped.

During the autumn of 1999, we also visited six of the main storage centres of metropolitan France. After the discovery of larvae of *Ae. albopictus* in Normandy (Schaffner & Karch, 2000), numerous specimens (larvae, pupae and adults) were collected in Poitou-Charentes between October 12th and 29th. However, we could not confirm the presence or absence of the species elsewhere, due to the lateness of the survey (after November 25th). We proceeded to collect eggs and larvae from tyres, trapping adults with dry-ice traps and human bait, and collecting in nearby breeding sites.

The first site was located in a small village named Montsecret (Orne, Basse Normandie; 48°48'30"N, 0°40'30"W, altitude 145 m). About 7500 used tyres were piled outside, 1500 in containers or under a plastic sheet and 2000 in closed sheds. One batch of damaged tyres has been stored outside for several years. The tyres originated from various countries (Belgium, France, Germany, Italy, Japan, Jordan, Netherlands, United Arab Emirates, United Kingdom and USA). Many (70%) of the tyres exposed to rainfall contained water and some

* ADEGE: agence nationale pour la démoustication et la gestion des espaces naturels démoustiqués, which grouped the main French public mosquito control organizations: Conseil Général de la Martinique, EID Atlantique, EID Méditerranée and EID Rhône-Alpes.

(40%) of them were mosquito breeding sites. A few *Ae. albopictus* larvae were found in a batch of tyres imported from the USA (Atlanta), that had been stored for 18 months. These tyres have been recapped in USA (the process destroys the eggs) and were not stored outside before exportation. This indicates that colonisation had certainly taken place in France. All entomological data and information collected from the local community (on and surrounding the site) indicate a low density of *Ae. albopictus*. However the area surrounding the site presents favourable conditions for the extension of the species: the presence of farm animals (donkeys, sheep, cattle and poultry) and numerous potential mosquito breeding sites (mainly agricultural silage covered with used tyres). These habitat characteristics, together with the large volume of traffic in tyres made the establishment of the species probable.

The second site from the same tyre recycling company is located in an industrial area near the city of Chatellerault (Vienne, Poitou-Charentes; 40°46'10"N, 0°30'20"E, altitude 64 m). This site receives only a limited quantity of imported tyres (one container from Japan every two years), but it is in contact with the Normandy site (240 km away) through regular exchanges. In this storage centre, some 9500 used tyres were piled outside, 1000 under a plastic sheet and 3000 in closed sheds. Some tyres came from Japan and the USA, but most were of local origin. Among them, a large batch of damaged tyres has been stored up to seven years (about 800 tyres). Many (90%) of the tyres exposed to rainfall contained water and 80% were mosquito breeding sites. *Aedes albopictus* was found as larvae and pupae, and adults were collected in vegetation. A biting nuisance was also noted on the site and many tyres were found with larvae. A majority of these tyres had a local origin, therefore the origin of the introduction could not be identified. The density of the population and the numerous positive tyres indicate that reproduction has been taking place on the site, perhaps for a few years. The site habitat characteristics present favourable conditions for the expansion of the species: numerous potential breeding sites, wild animals and resting places. It can also be noted that climatic conditions seem more favourable to the species here than on the first site, as active adults have been collected at the end of October. Biting nuisance was reported by the neighbouring population, which might be explained by the high density of anthropophilic species. In fact, other species were present in the tyres: *Anopheles claviger* s.s. (Meigen), *Anopheles plumbeus* Stephens, *Ochlerotatus geniculatus* (Olivier), *Culex pipiens* s.l. Linnaeus, *Culex hortensis* Ficalbi (non-anthropophilic species) and *Culiseta annulata* (Schrank). These species were also present in the first site, but in lower densities.

Larvae and adults disappeared after the cold period in November. This is indicative of winter egg diapause, an adaptation common in temperate region mosquitoes. Its expression may, depending on the origin of the immigrant mosquitoes, result in variable numbers of overwintered eggs hatching in the spring. The northern locations of these records may seem surprising, especially since the species has not been found in the warmer conditions of the Mediterranean coast bordering Italy, where the species is well established only 60 km from the frontier. The presence of *Ae. albopictus* in France in tyre importation centres confirms the main means of dispersion, and the feasibility for the species to breed under relatively cold climatic conditions. The Normandy site is, up to now, the northernmost record for the species.

At the present time, all that is known with certainty is that it has been introduced into metropolitan France and that it is present on two sites. The situation could correspond to one of three scenarios of increasing gravity:

- the species was recently introduced, and no dissemination has taken place outside the sites;
- a first stage of dissemination has followed the introduction, but in a limited number of sites;
- the introduction is quite old, and dissemination has occurred in several sites.

At the request of the French Ministry of Health, and under the responsibility of the ADEGE, a surveillance program was implemented in 2000. Its objective was to specify the precise presence of the species in France, its introduction and distribution. No immediate treatment is planned but the two positive sites will be kept under surveillance, and the surveillance will be extended to other sites. Used-tyre importation centres presenting risks of introduction will be identified in accordance with the volume and origin of the imports. At the same time, legal measures will be reviewed to create new sanitary regulations. Finally, various legislative measures and treatment strategies will be presented by the committee to the ministry for the season 2001, either to eliminate the species from the territory or minimise its dispersal.

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Essential reading

The Malaria Challenge after one hundred years of malariology. Papers from The Malariology Centenary Conference held in Rome 1998. (Edited by M. Coluzzi and D. Bradley). Parassitologia 41 (1-3), i-vi + 1-528. Published 1999. ISSN 0048-2951

The editors, Mario Coluzzi and David Bradley, have collated eighty-six papers written by a total of several hundred international authors to celebrate over 100 years of malariology. They must be congratulated in publishing the book within a year of the Centenary Conference.

The papers are arranged under eight headings: Historical perspectives; Evolutionary and genetical backgrounds; Human parasite-vector interactions; Infection and disease epidemiology; Malaria control priorities and constraints; Implementation of malaria control; Progress in the development of malaria vaccines, and New century scenarios in malariology. There is also a short section with final remarks, and a closing address.

Almost all of the key workers in malariology have contributed to the conference papers as either sole author or as a member of a research team. The participation of so many esteemed researchers underscores the high standards of this international conference. The conference papers inform the reader of the current range of investigation and engender an appreciation of the impact of future multi-faceted research in the field of malariology. In particular, the application of molecular research to malariology is well documented, and the need for future vigilance against resurgence of malaria is captured in one of the last titles: "The need to maintain the rage". This highlights the need to ensure that appropriate attention is given to malaria, with adequate political and financial support.

The Malaria Challenge can be ordered by email from: lombardo.editore@tiscalinet.it

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