Invasive mosquito species in Europe and Serbia, 1979 – 2011

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INTERNATIONAL SYMPOSIUM ON CURRENT TRENDS IN PLANT PROTECTION with
ESENIAS WORKSHOP - MANAGING INVASIVE ALIEN SPECIES IN SE COUNTRIES:
THE WAY AHEAD – Belgrade, September 2012
Biological invasion

Definitions

✓ **Exotic/non-indigenous**: transported from it’s natural geographic range to a recipient biotope where it never was before

✓ **Invasive**: an exotic species that proliferates in a recipient ecosystem

(1) Introduction – (2) Establishment – (3) Spread

- Introduced exotic species - 1
- Invasive species - 1, 2, 3
- Intercepted exotic species – 1 (2, 3)

Asian tiger mosquito *Ae. albopictus*

[www.issg.org](http://www.issg.org)
Mosquitoes

Diseases

Invasion

Risk

Surveillance

Control
Invasive *Aedes* mosquitoes

- Container-breeding species
- Eggs: resistant to desiccation
- No restrictive host preferences
- Dissemination by human activities
- Adapted to temperate climate (+ winter diapause)

**Risks**

- Threat to biodiversity
  - Homogenization of biota with cosmopolitan spp.
  - Second cause, after habitat loss, of sp. endangerment and extinction
  - Restoration of native diversity impossible

- Threat to human and/or animal health
  - Biting nuisance / mosquito-borne diseases transmission
Invasive mosquito no.1: *Aedes albopictus*

- *Stegomyia albopicta*
- The ‘Asian tiger mosquito’
- Invasive, native from Asia, spreading worldwide
  - Pest species mainly outdoor, during day
  - Efficient vector of Chikungunya, Dengue, filariosis
  - Competent for many other viruses
- Lays the egg above the water surface
  - Breeds in man-made habitats (containers, catch basins…)
- Overwinters as eggs in containers
Worldwide expansion started in Albania

- Probably imported in container shipments from China in mid-1970s (1975)
- Infestation discovered in 1979, initial infestation probably at a rubber factory close to port of Durres
- First record outside Oriental and Australasian regions
- Established all over the country

Adhami and Reiter, 1998
Worldwide expansion of *Ae. albopictus*

Source: [http://www.landcareresearch.co.nz/](http://www.landcareresearch.co.nz/)

Enserink M., Science 2008
Successful invasion of Italy

**MULTIPLYING MOSQUITOES**

Data from June 2012 show that the Asian tiger mosquito (*Aedes albopictus*) has spread rapidly across southern Europe over the past decade.

- Absent
- Present
- No data
Records of *Ae. albopictus* in Montenegro and Serbia

Petrić et al. *In press.*
Montenegro first record

- First record 21.08.2001 in Podgorica - over 30,000 used tires checked.
- Penultimate one had some *Cx. pipiens* and one *Ae. albopictus* larvae (male).
- Tires sprayed with water – fire prevention.
- Infested tire made in France, imported from Germany.
- In 2002 established in Podgorica – tire shops (imported from France, made in France, Korea, The Netherlands), discarded buckets and other water containers.

Podgorica region 2001-2002

Petrić *et al.* 2001
Montenegro – Podgorica climate

- Annual rainfall over 1400 mm
- Very dry summer, frequent shortages in water supply
- Poor water supply system, variety of small and big water collecting containers for home use with fluctuating water level present throughout the season
Montenegro - spreading

- In the course of ten years Asian tiger mosquito invaded all municipalities of Montenegrin sea coast and Scadar lake shore.

- Numerous colonies mainly in technical water and discarded containers, flower pot plates.

- In 2005, 2007, 2008 Ae. albopictus was registered in Andrijevica (E 19.50, N 42.46; altitude 720 - 850m a.s.l.), Northern Montenegro.

- Possible establishment of the species and adaptation to climatic conditions outside the limits of average temperature values foreseen for Europe.

- -2.6°C January, 19.3°C July
Montenegro coast July 2012

- Positive traps
- Negative traps
No eradication nor spreading limitation have been achieved by control measures so far.
Croatia - invasion from the sea.

First detection in Split

Žitko, pers.comm.
Monitoring program in Serbia 2009 - 2014

"Monitoring of invasive and vector mosquitoes and vector borne diseases", Research foundation of City Administration for Environmental Protection of Novi Sad, the first national project on invasive species 2009

Modelling and mapping the risk of establishment of *Ae. albopictus* in Europe

Predicted distribution 2030

Current distribution

MCDA model, 3 variables (annual precipitation, January and summer temperatures)

Schaffner et al., ECDC technical report, 2009
Invasive mosquito no. 2: *Aedes japonicus*

- **[Hulecoeteomyia japonica]**
- The ‘Asian rock pool’ or ‘Asian bush mosquito’
  - Invasive, native from Asia, spreading worldwide
  - Pest species mainly outdoor, during day
  - Suspected vector of West Nile
  - (and competent for several other viruses)
- Lays the egg above the water surface
  - Breeds in rock pools and man-made habitats (containers, catch basins…)
- Overwinters as eggs in containers
**Aedes japonicus** – Diagnostic characters of adults

Black and white mosquito, usually large, similar to *Ae. albopictus*, but differs in ornamentation of:

- mesonotum
- tip of palpi
- fourth and fifth tarsomere
**Ae. japonicus** – Recent territorial expansion

Native range: Far East (Japan, Korea, China, Russia)

- First established outside its native range in the USA in 1998, spread to 22 states including Hawaii, and parts of Canada (Williges *et al.*, 2008)

Europe:
- **France** (Normandy), 2000: detected on a platform for imported used tires (then eliminated) (Schaffner *et al.*, 2003)
- **Belgium**, since 2002: established, but so far only on two storages of used tyres (Versteirt *et al.*, 2009)
- **Central Europe**: Rapid spread in northern Switzerland and southern Germany (Schaffner *et al.*, 2009, Becker *et al*. 2011), Slovenia and Austria 2011 (Zeidel *et al*. 2011)
Distribution of *Ae. japonicus* in Switzerland 2008-2010

- 2009: progression of about 20 km in all directions
- 2010: progression in all directions, from 12 to 43 km
- **Doubling of the known colonized territory in Switzerland within one year, now covering approximately 10,000 km²**

Map: municipalities investigated for the presence of *Ae. japonicus*, 2008-2010

**Yellow arrows**: transects 2009-2010

Dots:
- **White**: negative sites
- **Black**: first positive in 2008
- **Orange**: first positive in 2009
- **Red**: first positive in 2010
Aedes japonicus
Current known distribution: June 2012
The box tree pyralid moth *Glyphodes perspectalis* and ‘Asian bush’ mosquito

Switzerland, 2007
(Schaffner *et al.*, 2009, Becker *et al.* 2011, Zeidel *et al.* 2011)

Germany, 2007

(Marja J. van der Straten & Tymo S.T. Muus 2010)
Invasive mosquito no. 3: *Aedes aegypti*

[Stegomyia aegypti ]
‘Yellow fever mosquito’

- 2 sub-species
  - *Ae. aegypti aegypti*
    - Light coloured form
    - ‘Domestic’ form
    - Cosmopolite (tropics and sub-tropics)
    - High vector competence
  - *Ae. aegypti formosus*
    - Dark form
    - ‘Silvatic’ form
    - Africa, Indian Ocean Islands
    - Low vector competence
\textit{Aedes aegypti} – Diagnostic characters of adults
Aedes aegypti – Spread and hazards

- Important disease vector: YF, DENV, CHIKV
- Act as vector in overseas territories and was vector in Europe
- Highly anthropophagic and synanthropic
- Intolerance of cold temperatures will limit northerly spread (no diapausing eggs)

- Invades large parts of tropical region
- Present in the past in Southern Europe
- Spreading at the Black See cost (since 2001), introduced in Madeira (2004)
- Introduced by second hand tire trade in NL (2010)
Tropical mosquitos found in Brabant, eradication efforts begin

Monday 02 August 2010

Efforts have begun to eradicate three sorts of exotic mosquitos which have been identified in Brabant and which could pose a risk to public health.

Adults and larvae of the Asian tiger mosquito, the American rock pool mosquito and yellow fever mosquito have been found in used tyres imported by several different companies in the region.

None of the insects found in the Netherlands were carrying diseases such as dengue, West Nile fever and yellow fever, according to the RIVM Public Health Institute.

French experts, who have years of experience in eradicating alien mosquitos, have been brought in to help eliminate the adults and larvae using insecticides. People living and working in the affected areas will be informed, health minister As Klink told MPs.

Checks on bamboo imports have been stepped up since 2006 because of the risk of importing tiger mosquitos.

DutchNews.nl
Aedes aegypti
Current known distribution: June 2012
Invasive mosquito no. 4: *Aedes koreicus*

[*Hulecoeteomyia koreica*]

- Native from Asia
- Original larval habitat: rock pools and tree holes
- Winter diapause in egg stage
- Potential vector of arboviruses (Japanese encephalitis)

- Introduced and established in Belgium (2008), Italy (2011?)
**Aedes koreicus** – Diagnostic characters of adults

Dark and light mosquito, similar to *Ae. japonicus*, but **differs in ornamentation of:**
- fourth and fifth tarsomeres bearing a basal white ring
- both black for japonicus
Aedes koreicus

Current known distribution: June 2012
Invasive species no. 5: *Aedes atropalpus*

*Georgecraigius atropalpus*

- Native from North and Central America
- Original larval habitat: rock pools
- Climate assessments suggest spread in Europe
- Readily bites humans; nuisance species
- Positive for WNV in US; vector status not clear

- Italy (1996), France (2003), Netherlands (2009)
- Introduced by used tire trade
- Limited information on ecology/biology
Aedes atropalpus – Diagnostic characters of adults

Dark and light mosquito, differs in ornamentation of:
- mesonotum
- abdominal tergal plates
Aedes atropalpus
Current known distribution: June 2012
Invasive species no. 6: *Aedes triseriatus*

[Obelotatus triseriatus]
‘American tree-hole mosquito’

✓ Native from North America
✓ Original larval habitat: tree holes
✓ Winter diapause at egg stage
✓ Introduced by second hand tire trade
✓ Larvae intercepted in France in 2004, in tires imported from USA (Louisiana)
✓ Primary vector of La Crosse virus in North America
✓ Potential vector of West Nile virus
Assessing and managing the risk induced by invasive mosquitoes in Europe

At European level (ECDC):

- **TigerMaps**: Development of *Ae. albopictus* risk maps (2008-09)
  - Produce a map that shows the precise current distribution of *Ae. albopictus* in Europe
  - Map the risk for establishment of *Ae. albopictus* in Europe, if being introduced

- **VBORNET**: Network of medical entomologists and public health experts (2009-2014)
  - Maintain and update existing databases or create new databases for vector surveillance and distribution
  - Ad-hoc technical support to ECDC: develop factsheets on important vectors
  - Inventory of VBD and related public health activities and expertise in Europe

VBORNET newsletter archive:
http://ergodd.zoo.ox.ac.uk/eden/index.php?p=82

VBORNET vector maps:
http://ecdc.europa.eu
Surveillance programmes of invasive mosquitoes

**Invasive mosquitoes**

Current known surveillance: January 2011

- Yes
- No
- No data
- No information

Outermost regions
- Azores (PT)
- Canary Islands (ES)
- Madeira (PT)
ECDC Guidelines for the surveillance of invasive mosquitoes in Europe

Commissioned by the European Centre for Disease Prevention and Control (ECDC). Coordinated by Laurence Marrama-Rakotoarivony and Herve Zeller. Produced by Francis Schaffner (Avia-GIS bvba, Belgium), Romeo Bellini (Centro Agricoltura Ambiente "G. Nicoli", Italy), Dušan Petrić (University of Novi Sad, Serbia), Ernst-Jan Scholte (National Centre for Monitoring of Vectors, Netherlands), with contribution of experts from Portugal, Spain and the USA.

News alerts in Eurosurveillance and Nature
http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=20265
http://www.nature.com/news/europe-on-alert-for-flying-invaders-1.11388

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