Mosquito monitoring and mosquito-borne disease risk in Belgium

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TIGER BITES: First confirmed cases of dengue fever contracted in Spain

By Karl Smallman - 10 October 2016 @ 16:45

TWO people from the same family have contracted dengue in Spain, according to sources from the Ministry of Health.
Scenarios of vector-borne diseases introduction

Are pathogens present?

Is the vector present?
What is their vector status?

Can transmission occur in Europe?
Mosquito-borne diseases by exotic vector species
Vector presence | exotic *Aedes* species in Europe

**Introduction**

establishment

spread

- *Aedes albopictus*
- *Aedes aegypti*
- *Aedes japonicus*
- *Aedes koreicus*
Vector presence | invasion pathways

Vector presence monitoring

Monitoring of exotic species in Belgium: MEMO-project

Source: ITM
Vector presence | sample processing
Vector presence | *Aedes albopictus*

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**Legend**
- Established
- Introduced
- Absent
- No data
- Unknown

**Countries/Regions not viewable in the main map extent**
- Malta
- Monaco
- San Marino
- Gibraltar
- Liechtenstein
- Andorra (PT)
- Canary Islands (ES)
- Madeira (PT)
- San Marino (NO)

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ECDC and ECHA map produced on 16 Jan 2019. Data presented in this map are collected by the VectorNet project. Maps are validated by external experts prior to publication. Please note that the depicted data do not reflect the official views of the countries. *Countries/Regions are displayed at different scales to facilitate their visualization. Administrative boundaries © Euroasis, ERMAS, Turkstat.*
Vector presence | situation in Belgium

## Vector status | vector competence and capacity

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Genus</th>
<th>Ae. aegypti</th>
<th>Ae. albopictus</th>
<th>Ae. japonicus</th>
<th>Ae. koreicus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellow fever virus (YFV)</td>
<td>Flavivirus</td>
<td>confirmed</td>
<td>laboratory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dengue virus (DENV)</td>
<td>Flavivirus</td>
<td>confirmed</td>
<td>confirmed</td>
<td>laboratory</td>
<td></td>
</tr>
<tr>
<td>Chikungunya virus (CHIKV)</td>
<td>Alphavirus</td>
<td>confirmed</td>
<td>confirmed</td>
<td>laboratory</td>
<td></td>
</tr>
<tr>
<td>Zika virus (ZIKV)</td>
<td>Flavivirus</td>
<td>confirmed</td>
<td>confirmed</td>
<td></td>
<td>laboratory</td>
</tr>
<tr>
<td>Dirofilaria (Dirofilaria immitis, D. repens)</td>
<td>Filarial nematode</td>
<td>confirmed</td>
<td></td>
<td>laboratory</td>
<td></td>
</tr>
<tr>
<td>West Nile virus (WNV)</td>
<td>Flavivirus</td>
<td>laboratory</td>
<td>laboratory</td>
<td>laboratory</td>
<td></td>
</tr>
<tr>
<td>La Crosse virus (LACV)</td>
<td>Orthobunyavirus</td>
<td>laboratory</td>
<td>laboratory</td>
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</tr>
<tr>
<td>Eastern equine encephalitis virus (EEEV)</td>
<td>Alphavirus</td>
<td>laboratory</td>
<td>laboratory</td>
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<tr>
<td>Venezuelan equine encephalitis virus (VEEV)</td>
<td>Alphavirus</td>
<td>laboratory</td>
<td></td>
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<tr>
<td>Japanese encephalitis virus (JEV)</td>
<td>Flavivirus</td>
<td>laboratory</td>
<td>laboratory</td>
<td>laboratory</td>
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<tr>
<td>St. Louis encephalitis virus (SLEV)</td>
<td>Flavivirus</td>
<td>laboratory</td>
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<td>laboratory</td>
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<tr>
<td>Western equine encephalitis virus (WEEV)</td>
<td>Alphavirus</td>
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<td></td>
</tr>
<tr>
<td>Jamestown Canyon virus (JCV)</td>
<td>Bunyavirus</td>
<td></td>
<td></td>
<td>laboratory</td>
<td></td>
</tr>
</tbody>
</table>

Pathogen presence | overview

Number of reported cases in EU/EEA 2015—2017

Chikungunya in Europe

2007 - ITALY
- Emilia Romagna, Castiglione di Cervia and Castiglione di Ravenna villages;
- ~330 suspected/confirmed cases
- Primary case: India
- CHIKV: ECSA E1-V226

2010 - FRANCE
- Var department, Fréjus city;
- 2 cases
- Primary case: India
- CHIKV: ECSA E1-A226

2014 - FRANCE
- Hérault department: Montpellier;
- 11 cases
- Primary case: Cameroon
- CHIKV: ECSA E1-V226

2017 - ITALY
- Lazio region: Anzio, Rome; Calabria region
- 238 suspected, 190 confirmed cases
- Primary case: India/Pakistan?
- CHIKV: ECSA E1-A226

2017 - FRANCE
- Var department: Le Cannet-les-Maures, Tadadeau
- 17 cases
- Primary case: Central Africa
- CHIKV: ECSA E1-V226
Dengue | Europe

2010 - FRANCE
- Alpes-Maritimes department, Nice (city)
- 2 cases
- Primary case: Unknown
- DENV: DEN-1

2010 - CROATIA
- Korčula Island and the Pelješac peninsula
- 3, plus one by serology
- Primary case: unknown
- DENV: DEN-1

2013—2015 FRANCE
- Bouches du Rhône department; Var department; Gard department, Nîmes.
- 1, 4, 7 cases
- Primary case: Guadeloupe, unknown, French Polynesia (?)
- DENV: DEN-1 & DEN-2

2018 - FRANCE
- Alpes Maritimes; Hérault department
- 1 case, 1 case
- Primary case: Unknown
- DENV: DEN-2

2018 - SPAIN
- province of Cádiz; Barcelona, Catalonia
- 5 cases + 1 case
- Primary case: unknown
- DENV: unknown

2018 - PORTUGAL
- Madeira island, Funchal city and surroundings
- ~2100 cases
- Primary case: Unknown (Venezuela?)
- DENV: DEN-1
Zika | seasonal risk of transmission

Source: Rocklöv et al. 2016
EBioMedicine, 9, 250–256
Mosquito-borne diseases by endemic vector species
West Nile fever situation in Europe

West Nile fever | transmission cycles

[Diagram showing the transmission cycle of West Nile fever]
West Nile fever | vectors

- **Competent vectors** (Vogels et al. Emerging Microbes & infect. 2017.6.e96)
  - *Aedes albopictus* → vector capacity?
  - *Aedes detritus*
  - *Culex modestus*
  - *Culex pipiens!*
    - No difference in vector competence between northern and southern European *Cx. pipiens*
    - No transmission was observed after 14 DPI at 18°C
    - Dutch and Italian *Cx. p. pipiens* population transmit WNV at similar rates at 23 and 28°C
    - Temperature as a limiting factor
MODIRISK | species distribution

<table>
<thead>
<tr>
<th>Species</th>
<th>Observed</th>
<th>Modelled</th>
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</thead>
<tbody>
<tr>
<td>Aedes annulipes</td>
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<tr>
<td>Aedes cantans</td>
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<td>Aedes caspius</td>
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<tr>
<td>Aedes cinereus/geminus</td>
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<td>Aedes communis</td>
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<tr>
<td>Aedes detritus s.s.</td>
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<tr>
<td>Aedes geniculatus</td>
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<tr>
<td>Aedes japonicus</td>
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<td>Aedes punctor</td>
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<td>Aedes rusticus</td>
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<tr>
<td>Aedes koreicus</td>
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<tr>
<td>Aedes sticticus</td>
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<tr>
<td>Aedes vexans</td>
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<tr>
<td>Anopheles claviger</td>
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<tr>
<td>Anopheles maculipennis s.l.</td>
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<tr>
<td>Anopheles plumbeus</td>
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<tr>
<td>Coquillettida richardi</td>
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<tr>
<td>Culiseta annulata</td>
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<tr>
<td>Culiseta moretiana</td>
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<tr>
<td>Culiseta pipiens</td>
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</tr>
<tr>
<td>Culex pipiens</td>
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<tr>
<td>Culex torrentium</td>
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</tr>
</tbody>
</table>

Number of individuals

Usustu virus infection | what can Usutu tell us?

- **Pathogen:** Usutu virus, genus *Flavivirus*, family *Flaviviridae*
- **First isolated:**
  - From a *Culex neavei* mosquito in South Africa in 1959
  - In 1996: emerged in Europe causing deaths among Eurasian blackbirds (*Turdus merula*) in Italy
- **Occurrence:**
  - USUV & WNV co-circulates in parts in southern Europe
  - USUV also more northern (Belgium, the Netherlands, Germany...)
- **Mosquito–bird–mosquito cycle**
  - Zoonotic potential of USUV
- **Vector:** *Culex pipiens* is a competent USUV vector
- **Birds:** primarily in *Turdus* spp

Phylogenetic tree of USUV variants responsible for outbreaks in captive and wild birds and the possible origin and spread pattern, western Europe, 2016. Eurosurveillance 2017. 22. 30452
**Mosquito-borne diseases** | summary and conclusion

- **Vectors**: presence and spreading (exotic *Aedes* mosquitoes)
- **Pathogens**: travel related cases
- **Transmission**: local transmission in several countries in Europe

- **Drivers**
  - Non-immune population
  - High travel volumes, increase during outbreaks
  - Transmission in areas where species are well established

- **In Belgium**: risk for local *Aedes*-borne viral diseases is very low

- Monitor and study of invasion of exotic, and endemic mosquito species
Partners & funding