



## Data Article

# Geographical data on the occurrence and spreading of invasive *Aedes* mosquito species in Northeast Italy



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## ABSTRACT

This article reports data on the occurrence and spread of three invasive mosquito species: *Aedes japonicus*, *Aedes koreicus*, and *Aedes albopictus* in two regions of Northeast Italy; resulting from larval and adult collections performed during the 2011–2020 period in the framework of different projects. Routine species identification was performed using morphological characters and complemented by molecular methods when required. For the years

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 Europe  
 Northeast Italy

2019 and 2020, detailed data are reported which update previous information on municipalities and sites where these species have been detected. Geo-referenced information on the presence of invasive mosquitoes is reported and demonstrated on maps. Additional data on the nature of breeding sites and the finding of native mosquito species in the same collections are also provided.

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**Specifications Table**

Subject	Biological sciences
Specific subject area	Entomology and insect science Entomological surveillance of invasive mosquitoes
Type of data	Tables, figures, additional Excel file
How data were acquired	Mosquitoes were collected from the framework of regional plans for invasive mosquito species surveillance. Target of these plans were the detection and spread of <i>Aedes koreicus</i> and <i>Ae. j. japonicus</i> in new areas. Data on invasive mosquito species found in the context of other projects were also included. Insects were collected by larval samplings from any type of water collection and by using two types of traps for adult mosquitoes. Morphological identification was made by stereoscope, using taxonomic keys. To confirm the first detection of <i>Ae. koreicus</i> and <i>Ae. j. japonicus</i> in a new municipality, molecular identification (PCR and sequencing) was performed.
Data format	Data are provided as Tables both in a raw format and analysed.
Parameters for data collection	Any collection that reports the presence of invasive mosquito species was considered and a consequent survey was carried out. After the initial identification of <i>Ae. koreicus</i> and <i>Ae. j. japonicus</i> in a new area, the neighbouring areas were monitored. Data are referred to two Italian regions (Northeast Italy).
Description of data collection	Sites and municipalities were considered positive if larvae, adults, or eggs (larval identification after hatching) of <i>Ae. koreicus</i> and <i>Ae. j. japonicus</i> were found, or negative when they were not found. This statement could not be applied to <i>Aedes albopictus</i> because its occurrence is already known all over Italy to be below 800 m a.s.l. Collections were made from March to October (2011–2020). A description of sampling carried out in 2019 and 2020, and of the breeding sites is provided in the additional file 1.
Data source location	Mosquitoes were collected from 11 provinces belonging to two Italian regions, Northeast Italy. Secondary data are displayed in tables for describing site/municipalities monitored and positive ones (invasive mosquito species detected). Details on sampling locations (primary data) are provided in the additional file 1.
Data accessibility	All raw data are available within the article and in an additional Excel file

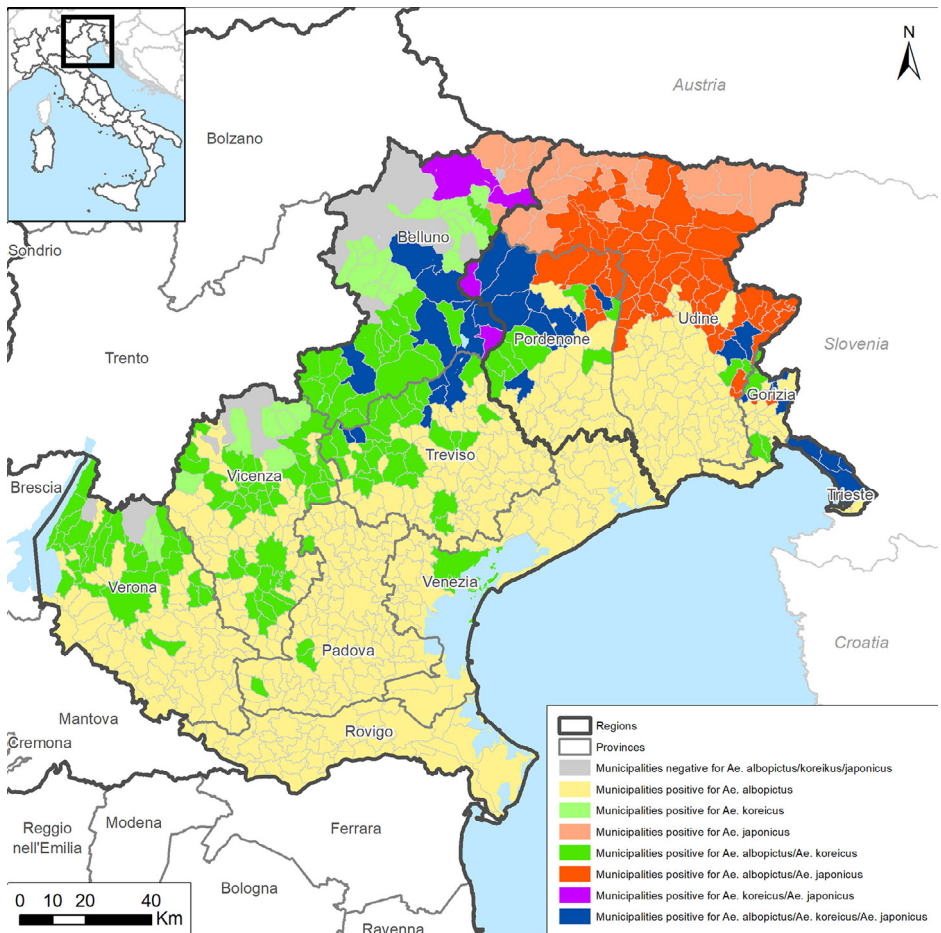
**Value of the Data**

- These data are important for updating the current distribution maps of *Ae. koreicus* and *Ae. j. japonicus* in Italy and Europe.
- Data on the occurrence and distribution of *Ae. koreicus* and *Ae. j. japonicus* could be used in population modelling to assess their spread.
- *Aedes koreicus* and *Ae. j. japonicus* could act as potential vectors of pathogens so far unrecorded in hilly and mountainous area of Northeast Italy.
- Knowledge of invasive mosquito presence permits to assess the risk for potential spread of vector-borne diseases.

## 1. Data Description

Data reported here were collected in the framework of regional plans (Veneto and Friuli Venezia Giulia Regions) for the surveillance of *Ae. koreicus* (syn. *Hulecoetomyia koreica*) and *Ae. j. japonicus* (syn. *Hulecoetomyia j. japonica*), which had been ongoing since 2011 and 2015, respectively. The sampling data collected up to 2018 have been reported by Montarsi et al., 2015 and 2019 [1,2]. The article aims to update the current distribution of these species in Northeast Italy with data collected in 2019 and 2020. *Aedes albopictus* was also reported when found in the mosquito samplings. A data summary of ten-year surveillance of invasive mosquito species (IMS) is reported in Table 1. During the last two years (2019–2020) of entomological surveillance, 578 sites within 224 municipalities were monitored in Veneto and Friuli Venezia Giulia (FVG) regions; locations where *Ae. koreicus* and *Ae. j. japonicus* were found are reported in Table 2 and described in the additional file (Additional file 1).

Detailed graphical visualization of IMS occurrence is shown in Fig. 1 (data updated up to 2020 is included). *Aedes albopictus* presence is also reported in the map assuming its widespread



**Fig. 1.** Occurrence of *Aedes koreicus*, *Aedes j. japonicus*, and *Aedes albopictus* in Veneto and Friuli Venezia Giulia regions (Northeast Italy) (updated up to 2020 is included). Municipalities negative or positive for one or more species are displayed in different colours.

**Table 1**Provinces within the Veneto and Friuli Venezia Giulia (FVG) regions, and the years when *Aedes koreicus* (A.k.), *Aedes japonicus* (A.j.), *Aedes albopictus* (A.a.) were found.

Year	Veneto															FVG																	
	BL			TV			VR			VI			VE			PD			RO			PN			UD			GO			TS		
	A.a.	A.k.	A.j.	A.a.	A.k.	A.j.	A.a.	A.k.	A.j.	A.a.	A.k.	A.j.	A.a.	A.k.	A.j.	A.a.	A.k.	A.j.	A.a.	A.k.	A.j.	A.a.	A.k.	A.j.	A.a.	A.k.	A.j.	A.a.	A.k.	A.j.	A.a.	A.k.	A.j.
2011	X	X		X			X			X			X			X			X			X			X			X			X		
2012	X	X		X	X		X			X	X		X			X			X			X			X			X			X		
2013	X	X		X	X		X			X	X		X			X			X			X			X			X			X		
2014	X	X		X	X		X	X		X	X		X			X			X			X			X			X			X		
2015	X	X		X	X		X	X		X	X		X			X			X	X		X			X	X		X			X		
2016	X	X		X	X		X	X		X	X		X			X			X	X		X			X	X		X			X		
2017	X	X		X	X		X	X		X	X		X		X	X			X	X		X			X	X		X			X		
2018	X	X	X	X	X		X	X		X	X		X	X		X	X		X	X		X			X	X		X			X		
2019	X	X	X	X	X		X	X		X	X		X	X		X	X		X	X	X			X	X	X	X	X	X	X	X	X	X
2020	X	X	X	X	X	X	X	X		X	X		X	X		X	X		X	X	X			X	X	X	X	X	X	X	X	X	X

Note: Provinces: BL (Belluno), TV (Treviso), VR (Verona), VI (Vicenza), VE (Venezia), PD (Padova), RO (Rovigo), PN (Pordenone), UD (Udine), GO (Gorizia), TS (Trieste).

**Table 2**

Number of municipalities and sampling sites monitored and positive for *Ae. koreicus* (A.k.) and *Ae. j. japonicus* (A.j) in the provinces of Veneto and Friuli Venezia Giulia (FVG) regions, 2019–2020.

Year	Municipalities			Sites				
	Monitored	A.k. positive (%)	A.j. positive (%)	Monitored	A.k. positive (%)	A.j. positive (%)		
2019	<b>Veneto</b>	BL	9	9 (100.0)	3 (33.3)	26	23 (88.4)	5 (19.2)
		TV	2	2 (100.0)		3	3 (100.0)	
		VR						
		VI	29	20 (68.9)		76	29 (38.1)	
		VE						
	PD	1	1 (100.0)		9	5 (55.5)		
	FVG	PN	10	5 (50.0)	6 (60.0)	29	12 (41.3)	17 (58.6)
		UD	29	2 (6.8)	26 (89.6)	57	2 (3.5)	44 (77.1)
		GO	12	7 (58.3)	7 (58.3)	29	12 (41.3)	9 (31.0)
		TS	4	4 (100.0)	4 (100.0)	18	6 (33.3)	8 (44.4)
<b>Total</b>		<b>96</b>	<b>50 (52.1)</b>	<b>46 (47.9)</b>	<b>247</b>	<b>92 (37.2)</b>	<b>83 (33.6)</b>	
2020	<b>Veneto</b>	BL	15	10 (66.6)	5 (33.3)	35	14 (40.0)	5 (14.2)
		TV	30	16 (53.3)	6 (20.0)	54	25 (46.2)	6 (11.1)
		VR	31	20 (64.5)		72	32 (44.4)	
		VI	30	17 (56.6)		86	31 (36.0)	
		VE	1	1 (100.0)		4	1 (25.0)	
	PD	4	3 (75.0)		6	4 (66.6)		
	FVG	PN	14	10 (71.4)	11 (78.5)	29	11 (37.9)	17 (58.6)
		UD	18	2 (11.1)	12 (66.6)	33	2 (6.0)	13 (39.3)
		GO	5	2 (40.0)		6	2 (33.3)	
		TS	2	0	0	6	0	
<b>Total</b>		<b>150</b>	<b>81 (54.0)</b>	<b>34 (22.6)</b>	<b>331</b>	<b>122 (36.8)</b>	<b>41 (12.3)</b>	

Note: Provinces: BL (Belluno), TV (Treviso), VR (Verona), VI (Vicenza), VE (Venezia), PD (Padova), PN (Pordenone), UD (Udine), GO (Gorizia), TS (Trieste).

occurrence in any areas below 800 m a.s.l. Different colours are used to show the municipalities positive for the presence of *Ae. koreicus*, *Ae. j. japonicus*, and *Ae. albopictus*. The map was created using the ArcGIS software, version 10.5.1.

An additional file (Additional file 1) with a complete dataset of surveillance carried out in 2019 and 2020 is provided and includes three major groups of information: (a) geo-referenced details of the sampling locations (province, municipality, waypoint, elevation, date); (b) characteristics of sites, breeding sites/traps, method of sampling, species identification; and (c) projects under which mosquitoes were collected.

## 2. Experimental Design, Materials and Methods

After the initial identification of *Aedes koreicus* in 2011 [3] and *Aedes japonicus* in 2015 [4] in Northeast Italy, more intensive surveillance was carried out to assess the spreading of these IMS. The monitored area included Veneto and Friuli Venezia Giulia (FVG) regions. This area is characterised by hills and mountains with sub-continental climate, characterised by cold and snowy winters and mild warm summers (mean daily temperature ranges from  $-2$  to  $3$  °C in winter and from  $17$  to  $22$  °C in summer). The rainfall may exceed 2200 mm/year on the Alps.

### 2.1. Mosquito surveillance and monitoring

The surveillance of invasive mosquitoes is a specific aim of the “regional surveillance plans for arbovirolosis” of the Veneto and FVG regions. The surveillance of IMS was carried out in ac-

cordance to the ECDC Guidelines [5], by larval search surrounding the colonised areas and by surveillance at points of entry (PoE). The latter was conducted at three sites (port and airport of Venice and airport of Treviso) using ovitraps and BG-Sentinel Traps (BG-Sentinel<sup>®</sup>, Biogents, Germany with BG-lure<sup>®</sup>).

In addition to the surveillance of IMS, adult mosquitoes were sporadically collected within the framework of other surveillance programs, such as the surveillance of West Nile and Usutu viruses, and the assessment of the efficacy of mosquitoes control measures. A link between samplings and projects is reported in Additional file 1.

## 2.2. Mosquito collections

The presence of invasive mosquitoes was evaluated by searching for mosquito larvae in potential breeding sites. In each municipality, 1 to 10 sampling sites were checked; especially tire markets, greenhouses, cemeteries, public and private gardens, streets, depot, dumps, farms, industrial areas, and forests. Any kind of container, both man-made and natural, in rural or urbanised areas was checked. After the initial identification of *Ae. koreicus* and/or *Ae. j. japonicus* in a municipality, the surveillance was extended to the neighbouring municipalities to detect their potential spread. The sites were chosen after an inspection of the area following the local health authorities' suggestion. Sample data were recorded on a paper form during the sampling and then in the laboratory, entered into a dedicated data management system (Entobase, developed by Istituto Zooprofilattico Sperimentale delle Venezie, IZSve) and into a Microsoft Excel sheet (here attached as Additional file 1). All the collection sites were geo-referenced in decimal degrees.

The larval collection was performed using a standard dipper (500 mL, 10 cm diameter). The collected larvae were placed in Falcon<sup>®</sup> tubes in refrigerated containers and delivered to the laboratory for identification.

Egg collection was performed using standard ovitraps ( $n = 7$  ovitraps/site), consisting of a 300 mL black plastic cup filled with water and a Masonite<sup>®</sup> stick measuring  $15 \times 2$  cm. The sticks were collected weekly, from June to October. Eggs were hatched in IZSve laboratory and fourth-stage larvae were morphologically identified, as described below.

Adult mosquitoes were collected using CO<sub>2</sub>--CDC traps (IMT<sup>®</sup> - Italian Mosquito Trap, Cantù, Italy) and BG-sentinels. CO<sub>2</sub>--CDC traps were activated overnight every two weeks from mid-May to mid-November. BG-sentinels ( $n = 3$  traps/site), used without dry ice, ran continuously for a week, from June to October. Adult mosquitoes captured by CO<sub>2</sub>--CDC traps and BG-sentinel were collected the day after and at the end of the week, respectively, and delivered to the laboratory for identification.

## 2.3. Mosquito identification

Adult mosquitoes and fourth-stage larvae were identified morphologically as described by references [6,7]. In case of the first detection of *Ae. koreicus* or *Ae. j. japonicus* in a municipality, the specimens were also identified molecularly. DNA extraction, amplification, and sequencing were performed as described by reference [8].

## Ethics Statement

Not applicable.

## CRedit Author Statement

**Francesco Gradoni, Michela Bertola, Alice Michelutti:** Writing – original draft; **Francesco Gradoni, Alice Michelutti, Sara Carlin, Sonia Accordi:** Investigation; **Federica Toniolo:** Formal analysis; **Alice Michelutti, Michela Bertola, Patrizia Visentin, Simone Martini, Tommaso Patregnani, Luca Terzo, Giuseppe Candela, Davide Qualizza, Andrea Mulas, Pasquale Landini, Graziano Olivo:** Resources; **Stefano Adami, Marco Dal Pont:** Supervision; **Manlio Palei, Francesca Russo:** Funding acquisition.

All authors read and approved the final manuscript.

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## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships which have or could be perceived to have influenced the work reported in this article.

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## Supplementary Materials

Supplementary material associated with this article can be found in the online version at doi:[10.1016/j.dib.2021.107047](https://doi.org/10.1016/j.dib.2021.107047).

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