EVIDENCE BASED RISK ASSESSMENT

FINDINGS OF OVERWINTERING *AEDES ALBOPICTUS* (ASIAN TIGER MOSQUITO) POPULATIONS IN BELGIUM, 2023

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<tr><th>Date of the signal</th><th>Date of the ERA</th><th>Signal provider</th><th>Experts consultation</th><th>Method</th></tr>
<tr><td>August 2023</td><td>December 2023</td><td rowspan="3">Results of surveillance of Aedes albopictus (MEMO+ project)</td><td rowspan="3">Permanent experts:
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RISK ASSESSMENT SUMMARY

The finding of overwintering *Aedes albopictus* populations in at least two places in Belgium in 2023 is of public health concern. Belgium has passed from a scenario with no established *Ae. albopictus* populations to a scenario of locally established populations. Further expansion of the mosquito populations together with new introductions will eventually lead to established populations in the whole Belgian territory in the coming years. Based on the experience from other European countries, there will be a real risk of transmission of *Aedes*-borne diseases, such as dengue, chikungunya and Zika in Belgium in the coming years (range between one and ten years after establishment of the vector).

In case of local transmission, the short-term impact on the health of the population would probably be low. However, as seen in other European countries, over time there is a high likelihood of having more and more outbreaks with higher number of cases, resulting in an important disease burden with, in some cases, severe forms. Moreover, it will also have an important economic impact as on one hand outbreak response will imply an important deployment of resources, such as for active case finding, vector control around cases, sensitisation of the population, etc.. in the other hand the nuisance aspect of the *Aedes albopictus* can have an important impact on the quality of people's life and can also affect tourism.

Since the establishment is still in an early stage, there is a window of opportunity in Belgium to delay the process and thus also delay the occurrence of autochthonous local transmission of the virus. This is only possible if there is sufficient funding allocated to a comprehensive monitoring of the entomological situation, to vector control actions and to human disease and pathogen surveillance.

RECOMMENDATIONS

There is a need for a "**National Action plan for the prevention and control of *Aedes albopictus* and the prevention of *Aedes*-borne diseases**" in Belgium. The end goal of the action plan should be to avoid local transmission of diseases. To achieve this, different aspects need to be considered and addressed in the plan, in line with the integrated *Aedes* management system (IAM) according to different scenarios (Annex II).

1) There should be a **sustainable surveillance of the vector**, to document the presence of *Ae. albopictus* and early detect introductions in the whole country. As it is currently the case, the monitoring should include a passive (based on the participation of citizens) and an active part. The latter should also include monitoring of the spread and density of vector populations, overwintering and efficacy of control measures (when applied). The goal of the surveillance and the methodology (especially for the active part) should be adapted according to the evolving situation. This requires the allocations of enough funding in a sustainable way (not project based), with possibility to adapt the financial resources according to the needs.

2) **Human disease surveillance** of dengue, chikungunya and Zika (further referred to as *Aedes*-borne diseases (ABD)) should be enhanced. This means an exhaustive and timely (daily or when a diagnostic) reporting of all cases, through laboratories (NRC and other diagnostic labs performing testing for these diseases) and mandatory notification by physicians. Health authorities should include in their mandatory notifiable disease list all cases of ABD, imported and locally acquired. Enhanced surveillance of ABD in areas where potential vectors are present during the mosquito season is crucial for an early detection and appropriate vector and disease control measures, and as such prevent local transmission. In addition, the possibilities of deploying diagnostic capacity in Belgium should be explored, to be ready to face the need of rapid diagnosis if clusters of autochthonous cases become common.

3) Results of the surveillance of the vector and diseases in humans should be integrated, in order to facilitate communication and management. For this purpose, a secure mechanism should be set up for the **exchange and linkage of data** on cases of ABD (from mandatory notification and laboratory results) and entomological data (location of *Ae albopictus* populations). There is a need for real-time data sharing between the different governance levels. A working group could be created, to discuss the feasibility and modality of a central IT-tool for data exchange, taking into account GDPR aspects.

4) An **efficient control strategy** should be implemented, with clear guidance on the control actions needed according to different scenario's (control to eliminate populations when still very local, to prevent spread in starting populations, to diminish nuisance in colonised areas, around an imported case where *Ae. albopictus* is established).

    - There is also need for e clear management strategy; who does what, when, how to organize the work in order to use and prioritize the funding that is available as efficient as possible.
    - Also, an overview of existing gaps and opportunities for vector control in the current context and legislation is needed, as there are currently some legal limitations for the use of some biocides, reducing the possibilities of choice of treatments used. Other non-biocide based vector control option should be explored and investigated, In any case, the efficacy of control measures should be monitored.

5) A **communication strategy** should be elaborated, targeting different aspects.
    - Since citizen-based surveillance has proven to be useful to identify introductions of *Ae. albopictus* in Belgium, therefore this type of surveillance should be further strengthened by giving as much visibility as possible to the citizen science website, in order to have as much notifications from citizens as possible. Though, to keep citizens interested and motivated to participate, it is important that action is taken following notifications. Specific students groups (e.g. agro, biology, etc..) and other relevant people could be engaged more in the citizen surveillance.
    - Greater awareness among the general public around *Ae. albopictus* should be created (in Belgium), on its potential to transmit diseases and prevention measures (i.e. how to decrease the mosquito population). The communication strategy needs to be organized in order to arise awareness and not spread panic.

- A website with centralised information around *Ae. Albopictus,* such as the current Surveillancemoustiques.be (managed by Sciensano) has proven to be useful. This should be further developed, where all information related to the epidemiological situation as well as the vector dispersal can be found, and with links to regional health and environment platforms for any specific procedures.
- Awareness should also be increased among GPs (general practitioner) and other physicians (e.g. hospitals) about ABD and the current public health threat during the mosquito season.

6) The prevention and control of vector-borne diseases is a complex task that requires the collaboration and coordination of multiple sectors and levels. **Strong governance** with a single point of contact at regional level will be needed, in order to strengthen the coordination and communication mechanisms between the local authorities (e.g. municipalities) and the regional competent authorities (for health and/or environment), for instance, when it comes to a finding in a new location or follow-up of management measures at a colonised location. Moreover, a transparent regional plan is needed for those aspects related to regional competences that will be part of the cascade of the national plan (there will always be a part that needs to be translated into the region' specific context). Clear governance and clear mapping of responsibilities and tasks will be essential to allow efficient collaboration.

Although most of the aspects above are regional competences, having a national plan with elements of guidance for the regions to implement, will allow to have a more harmonized approach nationwide. To build the plan and coordinate actions at regional level, a **coordination platform for Integrated Vector Management** should be created at national level, in close collaboration with the regions. By preference, existing consultation bodies should be used.

In addition to a national plan, **research** on the vector, on transmission of ABD and prevention and control should be stimulated in Belgium. This could include a fine-scale quantitative assessment using e.g. a modelling approach to have a better overview of the presence of the mosquitoes, of circulation and high risk areas for rapid spread of ABD.

Expert consultation

In order to identify the most urgent and priority actions to be taken/implemented among the recommendations above, the experts who participated to this advice were requested to give a scoring (high priority, medium priority, low priority) to the different subsections of the recommendations, through an online survey. From this, it results that making a "**National Action plan" for the prevention and control of *Ae. albopictus* and Aedes borne diseases**" is considered to be a high priority. Within this plan, the following aspects are considered to be the **most important**: having a system to exchange and link data; ensure the monitoring and control of the vector (and adapting it to the situation), enhance the surveillance of mosquito-borne diseases and create greater awareness among the general population. Results of the consultation can be found in annex V

An overview of **actions already taken** and **actions that should be taken** is available in **Annex I.**

CONTEXT

Aedes albopictus is an important vector of arboviruses such as dengue virus, chikungunya virus and Zika virus (further referred to as *Aedes*-borne viruses (ABV)). Over the past two decades, the species has invaded and expanded its range, spreading northward in Europe. It is currently present in all Belgian's neighbouring countries. In some of the countries where it is established, it has been responsible for local transmission of ABV.

In Belgium, up to 2012, *Ae. albopictus* (the Asian tiger mosquito) was detected only once in 2000. Its introduction was linked to an import company of used tyres. Since 2012, its introduction is monitored by active surveillance at points of entry (PoEs) such as parking lots along highways, used tyre or lucky bamboo import companies, with eggs larvae and adults of *Ae. albopictus* being detected almost yearly (1). Since 2018, regular introductions on parking lots via road transports has also been observed.

Since the start of passive surveillance through a citizen science platform in 2022, *Ae. albopictus* was notified in an important number of new locations primarily in residential areas, in addition to the PoEs still monitored, with indication of overwintering in at least two locations (see more information further under 1.2).

These observations are worrisome and require timely and specific actions. Further expansion of the mosquito populations together with new introductions will eventually lead to established populations in the whole Belgian territory in the coming years.

Taking into account the latest findings regarding *Ae. albopictus,* the fact that it is a known vector of ABV and that it has been involved in local transmission of these viruses in France, Italy and Spain, it is important to timely assess whether local transmission of one of these viruses could occur in Belgium. Indeed, in the current free of disease-scenario, but with the presence of the competent vector, it is considered essential to assess the likelihood of autochthonous transmission and the public health risk for the population.

BACKGROUND INFORMATION

1.1. HAZARD ASSOCIATED WITH *AEDES ALBOPICTUS*[1]

- **Health threat and biting nuisance**

Aedes albopictus is a known vector of chikungunya virus and dengue virus (3). All four dengue virus serotypes have been isolated from *Ae. albopictus* (4,5,6). The mosquito is also known to be able to transmit dirofilarial worms (7). Moreover, infection studies of *Ae. albopictus* suggest a possible contribution to Zika virus outbreaks (8,9); autochthonous cases of Zika occurred in France in 2019, with *Ae. albopictus* mosquitoes being the most likely mode of transmission (10).

Aside being the vector of dengue, chikungunya and Zika virus, *Ae. albopictus* is considered to be a competent[2] vector experimentally of at least 22 other arboviruses, including yellow fever virus, Rift Valley fever virus, Japanese encephalitis virus, West Nile virus and Sindbis virus, all of which are relevant to Europe (11, 12).

A number of viruses have also been isolated from field-collected *Ae. albopictus* in different countries and laboratory transmission of such viruses by *Ae. albopictus* has been demonstrated (3). These include Eastern equine encephalitis virus (13, 14). La Crosse virus (15,16), Venezuelan equine encephalitis virus (17, 18), West Nile virus (19,20, 21) and Japanese encephalitis virus (3). Usutu virus has been isolated from *Ae. albopictus* in Italy, but it is unknown whether the mosquito can transmit this pathogen (22). Field isolation and experimental infection studies alone do not prove that this mosquito species is involved in the transmission of such viruses, but the mosquito's biting habits, increasing global distribution and recent involvement in a chikungunya and dengue virus outbreak highlight the significance of *Ae. albopictus* to public health.

Moreover, since *Ae. albopictus* feeds on a wide range of hosts, it also has the potential to become a serious health threat as a bridge vector of zoonotic pathogens to humans (23).

Ae. albopictus is also known to be a significant biting nuisance. It is a day-time biter and its activity is concentrated during sunrise and in the afternoon, stretching until twilight. The mosquitoes can be particularly persistent when looking for blood, and the nuisance they cause is sometimes such that people avoid certain places. Unlike other mosquitoes, the tiger mosquito can bite multiple times for a single meal. So a single mosquito can cause a few welts. The nuisance provoked by *Ae. albopictus* can highly affect quality of life of the affected population and tourism if it establishes in touristic areas.

[1] Section mostly based on the ECDC fact sheet on *Aedes albopictus* : https://www.ecdc.europa.eu/en/disease-vectors/facts/mosquito-factsheets/aedes-albopictus

[2] Vector competence is the physiological ability of a mosquito to become infected with and transmit a pathogen, and is typically assessed in laboratory studies. In nature, transmission of a pathogen by vectors is dependent not only on vector competence but also on factors describing the intensity of interaction between the vector, the pathogen and the host in the local environment. Therefore, vector and host densities, geographic distribution, longevity, dispersal and feeding preferences have to be considered to determine the vectorial capacity of a vector population and its role in transmission.

- **Invasive species/global dispersion**

Ae. albopictus has undergone a dramatic global expansion facilitated by human activities, in particular the movement of used tyres and 'lucky bamboo' (3). Together with passive transit via public and private transport, this has resulted in a widespread global distribution of *Ae. albopictus*. It is now listed as one of the top 100 invasive species by the Invasive Species Specialist Group (24).

The success of the invasion of *Ae. albopictus* is due to a number of factors including: its ecological plasticity, its strong competitive aptitude, globalization i.e. increase of trade and travel, lack of surveillance, and lack of efficient control (3). Climate change predictions suggest *Ae. albopictus* will continue to be a successful invasive species that will spread beyond its current geographical boundaries (25, 26, 27). This mosquito is already showing signs of adaptation to colder climates (3,24) which may result in disease transmission in new areas.

Moreover, temperature is a critical factor on which both vector density and vector capacity depend: it increases or decreases vector survival, conditions the growth rate of the vector population, changes vector susceptibility to pathogens, modifies the extrinsic incubation period of the pathogen in the vector, and changes the activity and pattern of seasonal transmission. In general, increasing the temperature above 32°C results in a higher mosquito reproduction rate and thus increases mosquito density, shortens the extrinsic incubation period, and increases the contact rate by increasing the frequency of bites as they complete digestion more quickly. Some disease dynamics models estimate that increasing the temperature above 32°C increases the mosquito's vectorial capacity by up to three times (39).

1.2. SURVEILLANCE OF EXOTIC MOSQUITOES IN BELGIUM

In Belgium, the surveillance of (exotic) mosquitoes is a regional competency. This surveillance, has always been ad hoc, through specific projects. The first project related to the monitoring of mosquitoes in Belgium was the "**MODIRISK Project**: Mosquito vectors of disease: spatial biodiversity, drivers of change, and risk", funded by The Belgian Science Policy (Belspo) (51). The project was carried out in two phases, the first one between the end 2006 and 2009 and the second one between 2009 and 2011. The main objective of the project was to make an inventory of endemic and invasive mosquito species in Belgium, taking into account the environmental and taxonomic elements of biodiversity.

In 2012, the **ExoSurv project**, co-financed by the federal and federated entities, was carried out by ITM and it was the first attempt of the 'implementation of surveillance of exotic mosquitoes in Belgium' (52). Indeed, at the request of ÉCDC, this project aimed at evaluating the recently published ECDC guidelines supporting the implementation of tailored surveillance for Invasive Mosquito Species (IMS) of public health relevance. This six months project had six objectives: 1) to identify potential locations for the introduction and establishment of early-stage invasive exotic mosquitoes in Belgium ; 2) to assess the establishment of *Aedes j. japonicus* in Natoye and to verify the quality/effectiveness of the control measures used ; 3) to assess the establishment and potential spread of *Aedes koreicus* in Maasmechelen ; 4) to support the rapid implementation of control measures to eliminate the invasive exotic mosquitoes population; 5) to disseminate the results of the project to the scientific community, end-users and the general public ; 6) to detect potential locations for the introduction and establishment of invasive exotic biting midges at an early stage in Belgium.

In 2013 AFSCA took over the exotic mosquito monitoring for four years at 13 PoEs (between 2013 and 2015) and at 3 PoEs in 2016.

In 2014, following a decision of the Joint Inter-ministerial Conference on Environment and Health (JIMCEH), the working group on exotic mosquitoes and other vectors (EMOV) was set up as part of National Environment and Health Plan (NEHAP) which is hosted and funded by the FPS Public Health, Safety of the Food Chain and Environment. The working group is made up of delegates from the administrations of all the Belgian environment and health ministers and mainly includes people with expertise in biology and entomology. The aim of the working group is to map the presence of exotic mosquitoes, and more specifically the tiger mosquito, in Belgium: where are the mosquitoes located, how widespread are they, how do they enter the country, etc. A subgroup 'Vectors' of the working group EMOV, got the task to operationalise a national mosquito surveillance plan according to the document 'Programme for the surveillance of exotic mosquitoes in Belgium' produced by the working groups of the CIE and CIM and to add a proposition for an extension for ticks and *Culicoides*. In 2015, the provided document 'Towards a Belgian national vector surveillance plan' included a list of important vectors and related vector-borne diseases and procedures to be followed under different scenarios. It is based on this document that an agreement on the mosquito surveillance plan was made by the EMOV working group in January 2017, and a tender was published for the Monitoring of Exotic Mosquitoes at points of entry (PoEs) in Belgium. As a result, between 2017 and 2020, a project of three years, carried out by ITM, the Monitoring of Exotic Mosquitoes (**MEMO**) project, started. The main objectives of this project were : 1) to actively detect the possible introduction of Exotic mosquito species (EMS) in Belgium and quantify the already established local populations of EMS i.e. the active basic monitoring plan; 2) to detect, identify, evaluate and monitor potential import sites or points of entry (PoEs) based on existing passive monitoring data, experience gained and/or other relevant epidemiological or ecological information; and 3) to quantify the possible introduction and spread of newly detected EMS. Eventually this project was prolonged for six months until December 2020 (**MEMO+2020**), with four aims: 1) the active monitoring of *Aedes albopictus* at four parking lots along highways, 2) the preparation of information material for citizens and the media, 3) the preparation of training materials for public health staff and local partners and 4) the organisation of a training workshop for local staff in public health, Sciensano and Belgian defence.

In 2021, almost no entomological surveillance was carried and the EMOV working group of the NEHAP launched another tender for a one year project (extendable three times) in order to continue with the surveillance of exotic mosquitoes. This time though, it was requested by the CIMES that the surveillance would be rather focused only on exotic mosquitoes species with public health relevance as vector of viruses, i.e. *Aedes albopictus*.

Since September 2021, Sciensano and the Institute of Tropical Medicine, Antwerp (ITM) carry out the **MEMO+** project, which main purpose is to closely monitor the presence of exotic *Aedes* mosquitoes in Belgium through active and passive surveillance. Active surveillance is performed by ITM at eight PoEs, more specifically parking lots along a highway. Complementary, passive surveillance is performed through a citizen participation platform developed by Sciensano (www.MuggenSurveillance.be/www.SurveillanceMoustiques.be), where citizens can notify tiger mosquitoes by uploading their photos. Whenever possible the citizens observations are confirmed by a field inspection.

To date, this MEMO+ project has been carried out for two full mosquito seasons (2022 and 2023). Because of the late start of the project (September 2021), only one month of active entomological surveillance was implemented in 2021.The one year project has already been extended twice, so it can only be extended one more time. Moreover, the funding for the project is fixed and the yearly budget for the surveillance remains the same despite the increasing number of findings of *Ae. albopictus* in Belgium. Therefore, for the coming season the project might not be able to confirm the presence of *Ae. albopictus* in all new locations. Monitoring of spreading of the known populations will most probably not take place as they are not foreseen within the current budget of the project. For the same reasons, overwintering will be only investigated at a limited number of known locations.

Table 1 : Overview of the different (exotic) mosquito surveillance projects carried out in Belgium

Name of the project	Year	Carried out by	Method	Funding
Modirisk phase 1	2007-2009	ITM, RBINS, Avia-GIS, UCLouvain, WU	Inventory of endemic and invasive mosquito species	Belspo
Modirisk phase 2	2009-2011	ITM, RBINS, Avia-GIS, UCLouvain, WU	Inventory of endemic and invasive mosquito species	Belspo
ExoSurv	Jun-Nov 2012	ITM, Avia-GIS	Active surveillance at 23 PoEs	Federal and federated entities
AFSCA Monitoring	2013-2016	ITM	Active surveillance at 13 PoEs	AFSCA
MEMO	Aug 2017-Jul 2020	ITM, RBINS, RMCA, BopCo	Active surveillance at 23 PoE : (Used tyres companies, Lucky bamboo import companies, Airports, parking lots along highways.	Federal and federated entities through NEHAP
MEMO+2020	Aug-Dec 2020	ITM	Active surveillance at 4 PoEs (parking lots along highways)	Federal and federated entities through NEHAP
MEMO+	Sep 2021-Sep 2024	Consortium ITM and Sciensano, BopCo	Active surveillance at 8 PoEs (parking lots along highways) and passive surveillance through citizen science	Federal and federated entities through NEHAP

1.3. ENTOMOLOGICAL SITUATION OF EXOTIC *AEDES* SPECIES IN BELGIUM

The primary competent vector for transmission of ABV in Europe, *Ae. albopictus*, has now colonised most of southern Europe and is moving north (34, 35). It is fast spreading in Europe with an estimated rate of spread of about 100 km per year, rising to about 150 km per year in the period between 2014 and 2019 (36). It has reached all Belgian neighbouring countries and is well established in the majority of the French territory. Since 2005, it has been repeatedly introduced into the Netherlands (37) and in 2007 the species was detected for the first time in Germany with the first overwintering population in Freiburg in 2016.

In **Belgium**, through the monitoring described above, between 2000 and 2006, only *ad hoc* detections of exotic mosquitoes occurred. The first detection of an exotic mosquito happened in 2000, when *Ae. albopictus* was found in the framework of an investigation made by a French research team because of a link with a French tyre company. In 2002, a first detection of *Aedes* *japonicus* occurred, also by the same French research team. At that time, there was no formal mechanism to notify the Belgian authorities, as there was limited political awareness of the exotic/invasive mosquitoes situation in Belgium. Therefore, no control was implemented and no social mobilization was put in place.

From 2006 onwards, awareness on the topic increased due to its public health relevance (e.g. spread of West Nile virus in the USA, chikungunya outbreaks in Reunion Island and Italy). During the phase one of the Modirisk project (between 2006 and 2009) the presence of *Aedes japonicus* in Natoye (Wallonia) in 2007 and 2008 was confirmed and a first detection of *Aedes koreicus* was made in Maasmechelen (Flanders) in 2008 (28). In that period a first assessment was made by the RAG regarding *Aedes japonicus*.

In 2010, in the framework of the phase 2 of the Modirisk project, the populations of *Ae. japonius* and *Ae. koreicus* were longitudinally monitored in Natoye and Maasmechelen, which confirmed their establishment.

Between 2013 and 2016, *Aedes albopictus* was redetected yearly, twice at the same tyre company as in 2000, once at a new tyre company, three times at a lucky bamboo company and twice at the port of Antwerp in shipments with lucky bamboo destined for that same lucky bamboo company. As there was not an official communication channel, the regions were informally notified on these detections, but control was not always implemented or implemented with a delay (1).

Between 2017 and 2020, during the MEMO project, the mechanism for the notification of new detections of exotic mosquitoes became more formal, through the NEHAP EMOV working group. During this project, introductions of *Ae. albopictus* at the same import companies of tyres and lucky bamboo and at parking lots along highways were observed in 2018, 2019 and 2020. The population of *Ae. japonicus* and *Ae. koreicus* in Natoye and Maasmechelen remained there. Control activities, although not always immediately, were put in place, both in Flanders and Wallonia (1).

In 2022, as a result of the first year of the MEMO+ project, *Ae. albopictus* was found at 12 different locations in Belgium. Of these, nine were detected by citizens through the citizen science platform. Six field visits were performed following a notification from citizens to confirm its presence on site. Control was advised and applied in three of these sites (Lebbeke, Wilrijk and Kallo). This was the first time *Ae. albopictus* was found in urban areas in Belgium in private gardens. Moreover, *Ae. albopictus* were also found at three parking lots (Sprimont, Wanlin and Minderhout). Although a high number of mosquitoes was found in Sprimont, no *Ae. albopictus* larvae were found in the surroundings of the highway parking. Nevertheless, local reproduction of *Ae. albopictus* most likely happened (2).

During the 2023 season, *Ae. albopictus* was detected at 25 different locations, of which 16 through citizen surveillance (Evergem, Kessel-Lo, Drongen, Puurs-Sint-Amands, Gijzenzele, Kapelle-op-den-Bos, Roosdaal, Wolfsdonk, Oudenaarde, Wondelgem, Ath, Schaarbeek, Melle, Leuven, Schelle, Herstal) and seven through active surveillance at parking lots (Sprimont, Aische-en-Refail, Hondelange, Raeren, Wanlin, Saint-Ghislain, Minderhout). At two of these locations, Lebbeke and Wilrijk, *Ae. albopictus* was already found the year before. As both adult mosquitoes and eggs were found at precisely the same locations as the year before and early in the season in exactly the same period (mid-July) this indicates successful winter survival of the species in these locations. This is the first time such observation has been done in Belgium. Therefore it can be concluded that the tiger mosquito successfully overwintered in Wilrijk and Lebbeke (Figure 1).

Until last year (2022), tiger mosquitoes were regularly introduced in different locations through ground traffic, the importation of second-hand tyres and lucky bamboo. However, there was no evidence that they survived the winter. This is the first time that the surveillance shows the overwintering of the tiger mosquito in Belgium, marking a significant step towards their establishment in the country. Therefore, Belgium is currently entering a new scenario of locally established *Ae. albopictus* populations (Figure 2).

Figure 1: Overview of the findings of *Ae. albopictus* during 2023 season through active and passive surveillance

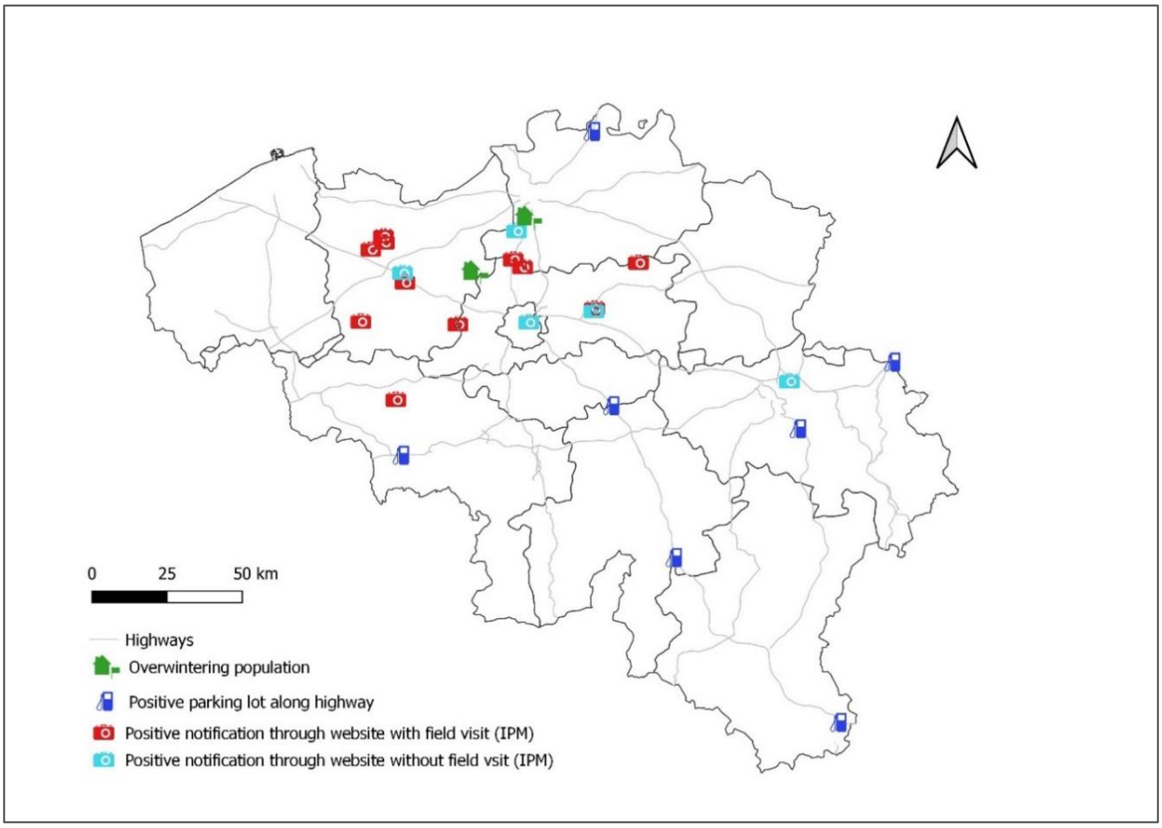
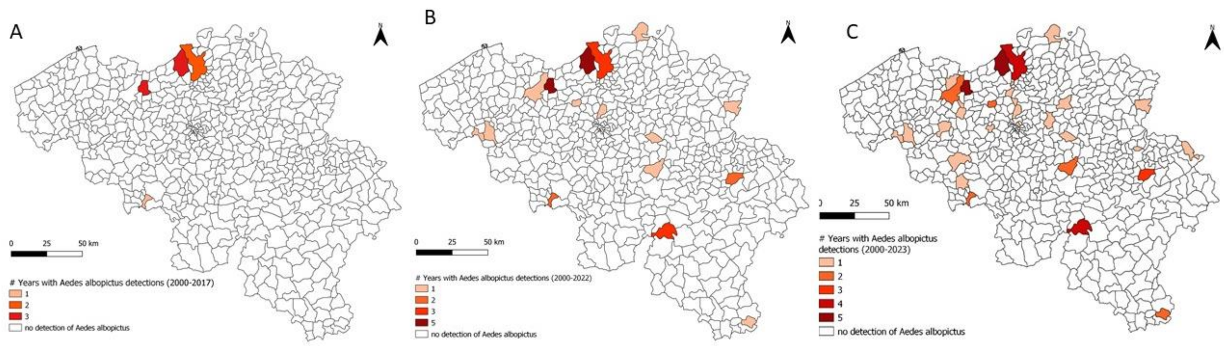


Figure 2: Number of years with detection of *Ae. albopictus* by municipality in Belgium. A) from 2000-2017 ; B) from 2000 – 2022 ; C) from 2000-2023 (source: ITM,)



Control of *Ae. albopictus*:
Vector control is a regional competency, and it is the environment authority which is currently organising and implementing vector control measures. For Flanders this is Agentschap Natuur en Bos (ANB), for Wallonia the Service Public de Wallonie (SPW) and for Brussels, Bruxelles Environnement/Leefmilieu Brussel. It should preferably be part of an integrated vector strategy (including monitoring/surveillance and communication).

For the moment, in Flanders, door-to-door control actions in a 150-200m perimeter are made by an appointed company, whilst rain gauges are treated in a 500m perimeter. Adaptations will be made based on the specific situation of each location and the available control techniques. There is a need for guidelines (at national and regional level). Implementation of control activities have specific challenges and an efficient approach is needed.

1.4. SURVEILLANCE OF ARBOVIRUSES IN BELGIUM

Surveillance of arboviruses in humans in Belgium, which is a regional competence, is indicator based, through laboratory diagnostics for dengue, chikungunya, Zika and yellow fever performed by the National Reference centre for arboviruses, located at the Institute of Tropical Medicine (ITM).

Aside of the National reference centre for arboviruses, other laboratories may also perform the diagnostic for dengue, chikungunya and Zika, but there is currently no complete overview of all the laboratories performing these diagnostics.

Moreover, dengue, chikungunya and Zika cases infected/contracted in Europe are mandatory notifiable in the four federated entities: Flanders, Brussels, Wallonia and OstBelgien, in line with the request at European level, in order to rapidly detect potential local transmission in a member state.

Prevention and control of infectious diseases is a regional competency. Therefore, if an autochthonous case would happen to be diagnosed/reported in Belgium, it would be the regional health agency that would be in charge of the investigation of the case, of putting control measures in place as well as of the prevention of further cases.

1.5. EPIDEMIOLOGICAL SITUATION OF *AEDES* BORNE DISEASES (IN BELGIUM AND ELSEWHERE)

1.5.1. International situation

Dengue is an endemic disease in more than 100 countries in Africa, the Americas, South and South-east Asia, and the Western Pacific region. The number of dengue cases has been increasing notably in the past few decades, and large outbreaks have been reported (53). Dengue viruses are highly mobile and transported by infected travellers. All four serotypes now co-circulate in many places around the world.

In Europe, dengue is not endemic and the vast majority of the cases are imported i.e., from travellers infected in endemic areas returning to Europe. However, vector-borne outbreaks of dengue have been observed regularly in recent years in certain southern countries where *Ae. albopictus* is established (see annex III for an overview). In 2022, an exceptional situation was observed in France, with an increase in the number of episodes, their intensity (i.e. number of cases) and the geographical areas concerned (29). In total, nine events of autochthonous local transmission of dengue were reported, with a total of 66 cases. Six of these episodes occurred in departments where no autochthonous cases had previously been reported. In 2023 outbreaks of autochthonous cases of dengue were reported in Italy (42 cases), Spain (1 cases) and France (43 cases). Local transmission was reported for the first time in October in the Paris region, being the most northerly case ever recorded in France, and in Europe.

Chikungunya is endemic in Africa, Southeast Asia, the Indian subcontinent, the Pacific Region and most probably in the (sub) tropical regions of the Americas (54). Large scaled outbreaks were reported in 2004-2007 from Kenya, Comoros islands, La Reunion, Mauritius, and then spread to various Indian states and South East Asia. In 2013, chikungunya virus emerged on the island of Saint Martin in the Caribbean and then quickly spread in the Americas. This was the first documented autochthonous transmission of chikungunya virus in the Americas. By February 2015, nearly 1.2 million suspected and confirmed cases of chikungunya virus disease were reported in the Caribbean and other regions of the Americas. In 2023 and as of 30 of September, approximately 440 000 chikungunya cases and over 350 deaths have been reported worldwide.
Chikungunya is not endemic in Europe and the majority of the cases are imported by travellers infected in endemic areas. When the environmental conditions are favourable, in areas where *Ae. albopictus* is established, local transmission of the virus can occur as demonstrated by the sporadic events of chikungunya virus transmission such as the one in Italy in 2007, with 217 laboratory-confirmed cases (65). This was the first outbreak reported in a non-tropical region where a competent vector for the chikungunya virus was present. Since this event, several sporadic events of local transmission have been reported in Europe (annex IV).
No locally acquired cases in continental Europe were reported in 2023.

Before 2007, the areas with reported **Zika** virus circulation included tropical Africa and south-east Asia. Very few outbreaks were documented prior to a 2007 upsurge on Yap Island, Federated States of Micronesia which was the first outbreak of Zika virus identified outside of Africa and Asia (30). Between 2013 and 2015, several significant outbreaks were notified on islands and archipelagos in the Pacific region, including a large outbreak in French Polynesia. In 2015, Zika virus emerged in South America, with further spread across the Americas (31, 32). These were the first documented transmissions outside of its traditional endemic areas in Africa and Asia.
In 2019, France reported three autochthonous cases of Zika. These are the first autochthonous cases of Zika acquired through vector transmission (by *Ae. albopictus*) within Europe (10).

1.5.2. Belgian situation

In **Belgium**, all reported cases of dengue, chikungunya and Zika are imported cases. The number of cases of these diseases diagnosed fluctuates from year to year, depending on the epidemiological situation in endemic countries, the occurrence of major epidemics and the choice of holiday/travel destinations.
On average, around a hundred cases of dengue are diagnosed each year by the NRC arboviruses, with the exception of 2019 with 200 cases, and 2023 with more than 210 cases, the highest number of cases since surveillance began in 2002 (Figure 3). The high number in 2019was linked to large outbreaks of dengue in South-East Asia, particularly Thailand,

Cambodia and the Philippines. In Belgium, travel related dengue cases have been mostly diagnosed in Flanders, followed by Wallonia (Figure 4).

For chikungunya, between epidemic episodes such as the one in 2006 in the Indian Ocean, the one in 2014 in the Caribbean and Latin America, and the ones in 2019 in Thailand and the Democratic Republic of Congo, the number of cases reported in Belgium is generally low (around ten cases annually) and stable (Figure 3). Cases of chikungunya have been mostly diagnosed in Flanders, followed by Wallonia (Figure 4). Moreover, although cases are diagnosed during all year long, there is a higher number of cases diagnosed between July and August (Figure 5).

For Zika, a large number of cases was reported in 2016 among travellers returning from Central and South America, following the epidemic of 2016 (Figure 3). Since then, a significant decrease in cases diagnosed in Belgium has been observed. No cases were reported between 2019 and 2021, one imported case was reported in 2022, and two (probably three) cases were reported in 2023.

Figure 3 : Total number of imported cases for dengue, chikungunya and Zika by year, Belgium 2006 – 2022. (Source: NRC arbovirus)

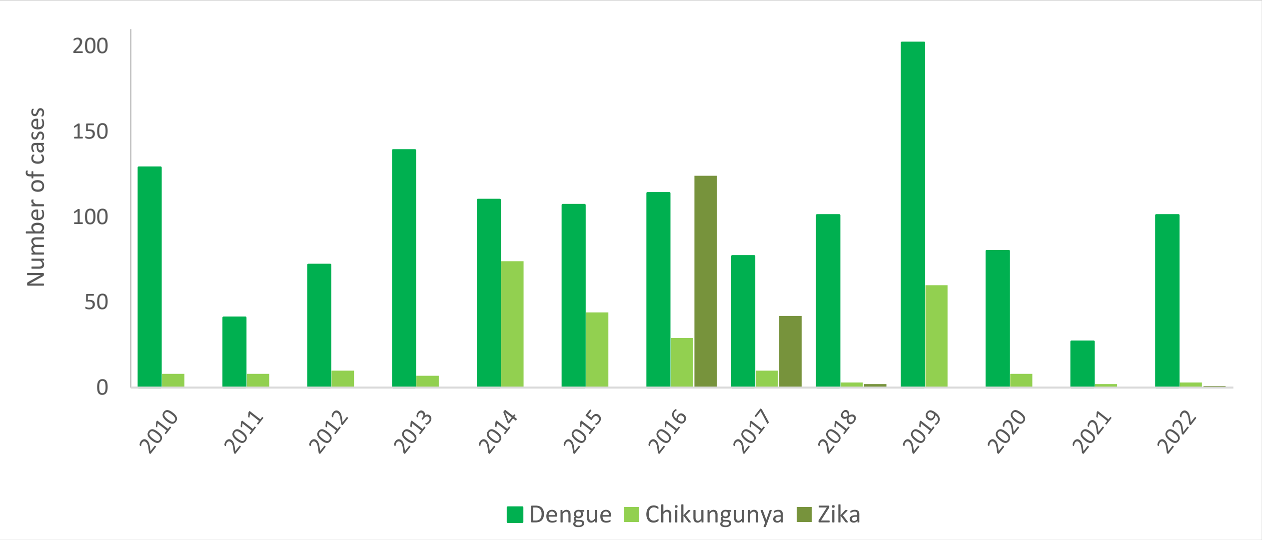


Figure 4 : Total number dengue and chikungunya imported cases diagnosed, by region and by year, Belgium 2018-2022. (Source: NRC arbovirus)

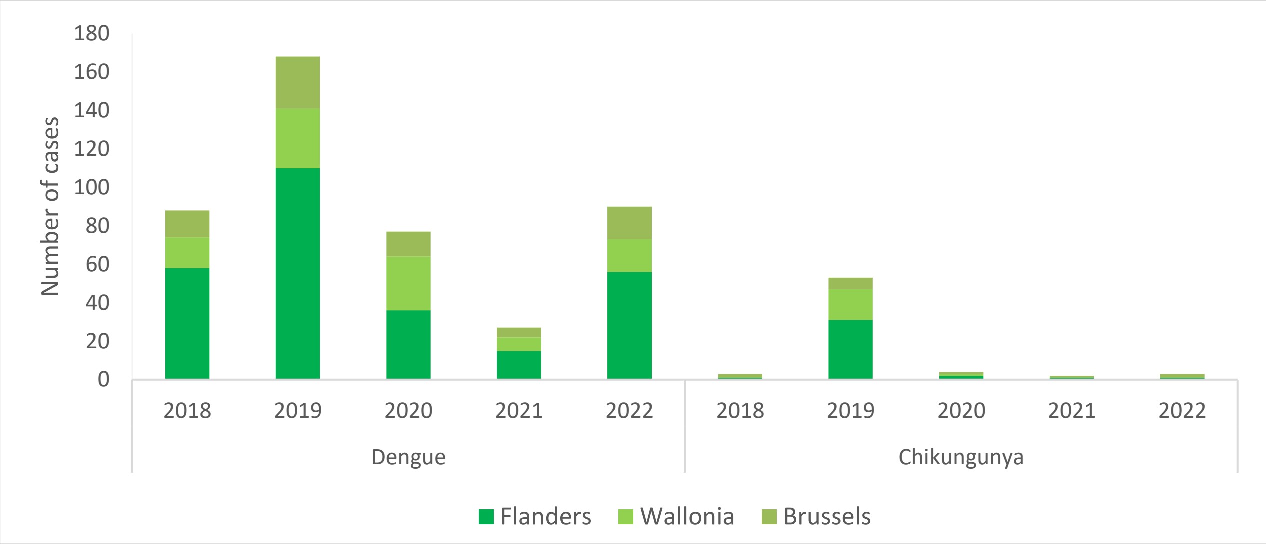
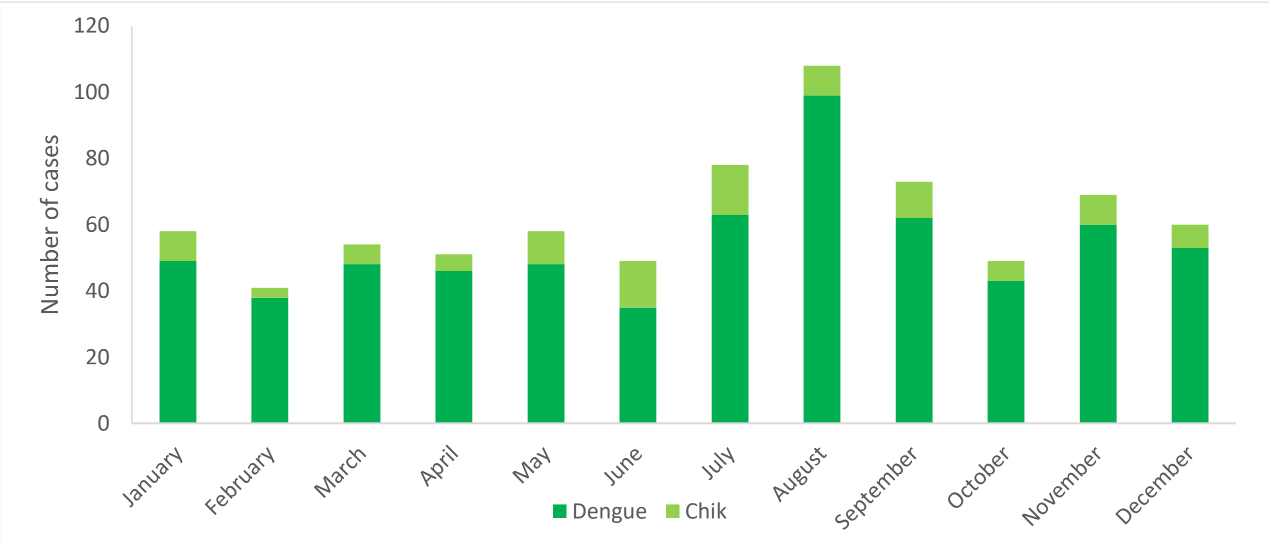


Figure 5 : Cumulative number of cases for dengue and chikungunya by month, Belgium, period 2016-2022 (Source: NRC arbovirus)



RISK ASSESSMENT

The main objective of this risk assessment is **to determine the risk of *Aedes*-borne viruses introduction and possible local transmission in Belgium**. For an autochthonous vector-borne virus transmission to occur, four conditions must be met. The first one implies the introduction and establishment of the exotic competent vector species. The second condition comprises the introduction of the virus through an infectious (in viraemic phase) person returning from an endemic country or a country with an outbreak; the third condition is that the mosquito bites the viraemic person and can infect another person after the completion of the 'extrinsic incubation period'[3]; and the fourth condition is the permissiveness of the environment to allow the transmission to occur. Therefore, to perform this assessment we analyse these conditions into the Belgian context.

1) Presence and spread/establishment of the vector

At this moment, the establishment of *Ae. albopictus* in Belgium is considered to still be in an early phase, most probably in a limited number of localities. But, if no actions are taken, new introductions with the potential of overwintering and the further expansion of established/overwintering populations (such as Wilrijk and Lebbeke) can be expected in the coming years resulting eventually in the establishment in the whole Belgian territory, particularly taking into account the predicted increases in temperature and rainfall for the coming years.

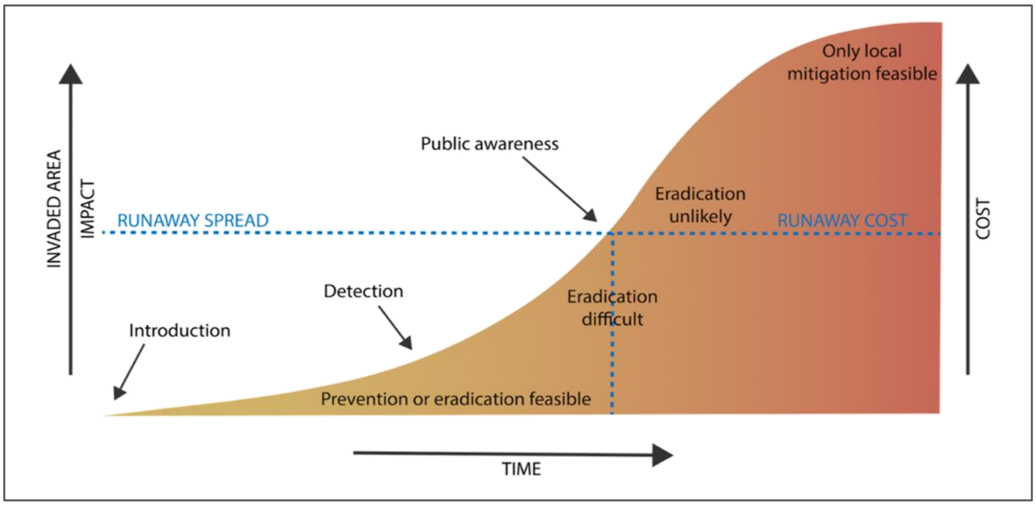
As per ECDC 'Guidelines for the surveillance of invasive mosquitoes in Europe' (40), three risk scenarios can be distinguished in the establishment of the *Aedes albopictus* in an area or a country.

- **Scenario 1** (no establishment)**:** There are multiple introductions of the mosquito, but without suitable conditions for overwintering and no successful establishment.
- **Scenario 2** (locally established, <25km^2)**:** Established populations of tiger mosquitoes occur locally following introductions.
- **Scenario 3** (widely established, >25km^2)**:** The mosquito is widely established with a risk of local transmission of mosquito-borne diseases (MBD).

Based on these scenarios, we can say that in Belgium we are very quickly, in a matter of years, moving from scenarios. Currently, we are in between scenario one (for several areas) and scenario two (for a couple of areas such as Wilrijk, Lebbeke and maybe others). We will soon be completely in scenario two. In which case, moving from scenario two to three will imply an important increase of costs (48) (Figure 6), both for monitoring (transition from surveillance of the introduction of the vector and of control efficacy to surveillance of both the spread/abundance of the vector, of the control efficacy and of imported cases of MBD in humans, in areas with established mosquito populations) and for control (transition from control of small areas and points of entry to larger complex areas involving more stakeholders). Once in scenario three, there is no way back.

[3] The extrinsic incubation period (EIP) is the viral incubation period between the time when a mosquito takes a viraemic bloodmeal and the time when that mosquito becomes infectious.

Figure 6 : The theoretical curve of an invasive species over time, as it has expanded into new areas since its introduction, increasing its impact and economic costs. For a time the eradication of the species is possible, but at a certain point it becomes impossible and only local measures can be taken to mitigate its effects. Prevention measures and surveillance systems help the species to be detected earlier and to act in time to eradicate them. Figure modified from the original of Ahmed et al. 2021. (Source: Mosquito Alert CC-BY)



If no actions related to the current situation of *Ae albopictus* in Belgium are timely taken, further expansion of these populations, to eventually the whole Belgian territory can be expected in the coming years. Since controlling a proper established population will be much more difficult and costly than preventing/delaying it to become established.

2) Presence of the virus

In Belgium, up to now there have been no evidence of autochthonous cases of ABD. There are however, yearly, a number of imported cases of ABD identified/diagnosed.

Although the viraemic period is short, the probability of transmission may be favoured by different factors such as for instance the social habits of the human population during the summer months, the number of returning of viraemic travellers from disease-epidemic areas. Moreover, the Belgian population is highly susceptible to the virus/disease due to the absence of virus circulation.

Based on this and on the description of the epidemiology of imported cases mentioned in point 1.5.2 here above, we can assess the risk of introduction of the ABV in Belgium through imported cases as high, and this particularly in July, August and September, which is the high period of the mosquito season.

3) Human contact with the vector

The local/autochthonous transmission of ABV is determined by complex interactions between humans and the vector. In the assumption that both conditions, i.e. presence/establishment of the vector and presence of the virus are met, then the risk of disease emergence would depend on the probability of the mosquito to pick up the virus first (the likelihood will increase with wide-spread establishment and higher mosquitoes densities) and on the probability of exposure of the population to the (infected) mosquito, which in turn depends on the infection rate, the vector density, environmental factors and socio-demographic characteristics of the human population.

Ae. albopictus has diurnal feeding habits, can live in the vicinity of human dwellings, and it is estimated that its period of greatest activity is between June and October, when the human population spends more time outdoors.

Aedes density directly influences the vectorial capacity for transmission. According to some studies in Asia, the threshold density of *Ae. aegypti* below which there would be no transmission would be very low (41). Recent autochthonous outbreaks in Europe, such as the dengue outbreak on the island of Madeira, where *Ae. aegypti* is the main vector, or the chikungunya outbreak in Italy, where *Ae. albopictus* was the main vector, showed that high vector densities coincided with the onset of the outbreak (42, 43, 64). For mosquitoes, high vector abundance is likely to be linked to increased likelihood of having autochthonous cases, and an increase in abundance may sometimes provide an early warning of potential pathogen presence and potential local transmission. Although the relationship vector and abundance is linear, there are other factors related to the vector (such as longevity and human-vector contact) that enter in the equation. Thus, high vector abundance does not necessarily mean that there will be pathogen transmission, or that either vector or pathogen will spread (44), but the risk increases.

In Europe, autochthonous outbreaks of arboviruses transmitted by *Ae. albopictus* typically follow 5-15 years after the introduction of the species (37). For instance in France, the first local transmission of dengue resulting in two autochthonous cases occurred in 2010 in Nice, while *Ae. albopictus* was known to be established since 2004 in south-east France (45,46). Also in France, the first autochthonous case of dengue reported in Ile-de-France was confirmed in 2023, in Limeil-Brévannes (Val-de-Marne), around 20 km southeast of Paris (47). These case occurred in a municipality that was not considered colonised by *Ae. albopictus*, based on the 2022 French entomological data (50). What all the cases have in common is that most of them are found in urban regions. In Italy in particular, we only see cases in the two most touristic regions, Milan and Rome. In France and Spain, many cases are found along the Mediterranean coast, but there are also hotspots in major cities such as Paris and Madrid. It is not surprising that transmission often occurs in urban environments as *Aedes* thrives in cities and urban areas have large numbers of returning viraemic travellers who have visited dengue endemic regions. Since dengue often is a very mild infection many cases go unnoticed, it can be assumed that there are a high number of unreported cases and that only a fraction of cases appear in surveillance statistics (66). Moreover, a systematic review on the role of urbanisation in the spread of *Aedes* mosquitoes and the diseases transmission showed a clear relationship of urbanisation with distribution and density of *Aedes* mosquitoes and a robust association between vector production, human population density, and disease transmission (67).

Based on the above, if *Aedes*-borne viruses are introduced into Belgium, and local transmission would occur, we can expect this to occur in urban areas with high population density, therefore the likelihood for having a high number of cases is high. Moreover, if local transmission occurs the impact on the health of the population will depend on the virus and serotypes circulating, the susceptibility of the population to the disease and the severity of the disease.

In case of local transmission, the short-term impact on the health of the population would most probably be low, as the most frequent clinical presentation of the disease in its emerging stage would be mostly mild. However, over time there is a high likelihood of having more and more outbreaks with higher number of cases as it is currently seen in France. In France this has result in an increase of sever cases (67). Therefore, if no actions are taken to prevent local transmission, an increase in the number of outbreaks and thus the number of autochthonous cases may result in an important disease burden with, in some cases, severe forms as currently seen in France. Also, if a second introduction of another viral serotype (of dengue for example) this could have more severe consequences. Moreover, outbreak response will imply an important deployment of resources, such as for active case finding, vector control around cases, sensitisation of the population, etc..

4) Permissiveness:

This fourth condition relates to the permissiveness of the environment (e.g. temperature, urbanisation) that affects/favours local transmission of the virus.´

Indeed, Climate change enhances dengue spatio-temporal expansion to non-endemic areas. Higher temperature increases vector capacity by increasing the average biting rate, probability of infectivity per bite either for the human or the vector, and rate of mosquito development. Therefore, it is related with the appearance of autochthonous cases and this explains the recent inflation in autochthonous dengue in Europe (68).

In most cases, permissiveness has been analysed through modelling. From the models analysing the climatic/environmental suitability for chikungunya, dengue and Zika virus transmission to occur in Belgium we can highlight the following :

- Three models predict a limited suitability for chikungunya in Belgium (55, 56, 57), yet with clear changes under climate change scenarios. However, other models state that more parts of central Europe and large parts of western Europe (including Belgium) have suitable temperature conditions for chikungunya (58,59). Of note is that one of these models had a relatively limited training set and relies heavily on temperature, hence the widespread suitability might be greatly an overestimation for central Europe (58, 59).
- Regarding dengue, Bhatt et al 2013 predict a low probability of occurrence in Western Europe including Belgium; Rogers et al., 2014 states that their global dengue risk maps show that very few areas of rural Europe are presently suitable for dengue, but several major cities appear to be at some degree of risk, probably due to a combination of thermal conditions and high human population density, the top two variables in many models (60, 61). From this modelling, there are clearly suitable spots in Belgium for local transmission of dengue.
- For Zika the suitability of Belgium seems to be low (62, 63).

The key point to take into account is that most of these models (at least the ones trained on disease occurrence) are very dependent on the distributions of the training points, especially from predictions at the edge of the range like Belgium. Therefore, results need to be interpreted with caution.

In conclusion, if an *Aedes*-borne virus is introduced into Belgium in an area with established *Ae. albopictus* populations the appearance of autochthonous cases would be possible in these areas. Although we cannot predict when this will happen, we can expect this will happen as the two main conditions for local transmission to occur (vector and pathogen) will be met. Therefore, there is an urgent need to be prepared to this scenario by having a National action plan which foresees which actions to take, how, when and by whom. More data are needed to determine whether there are areas more at risk than others for local transmission to occur in Belgium as well as specific population groups.

The likelihood of having autochthonous cases will depend primarily on where and when the virus is introduced and whether the vector is present or not, as well as the period of peak vector activity (i.e. between July and September). Therefore, it is of paramount importance to have a good view and understanding of the situation of *Ae. albopictus* in Belgium, and to do so a comprehensive entomological surveillance (detection of new introductions, monitoring of overwintering, spreading and establishment (seasonality/abundance) and an efficient entomological control is essential. In addition, an enhanced disease surveillance during the mosquito season is necessary in areas with established populations, in order to avoid local transmission of a diseases following importation of a virus.

In case of local transmission, the short-term impact on the health of the population would most probably be low. However, over time there is a high likelihood of having more and more outbreaks with higher number of cases, resulting in an important disease burden with, in some cases, severe forms. Moreover, it will also have an economic impact as outbreak response will imply an important deployment of resources, such as for active case finding, vector control around cases, sensitisation of the population, etc..

Aside the health impact due to the diseases burden, the nuisance aspect of the *Aedes albopictus* shouldn't be overlooked, since it can have an important impact on the quality of people's life and can also have an economic impact.

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ANNEXES

Annex I :

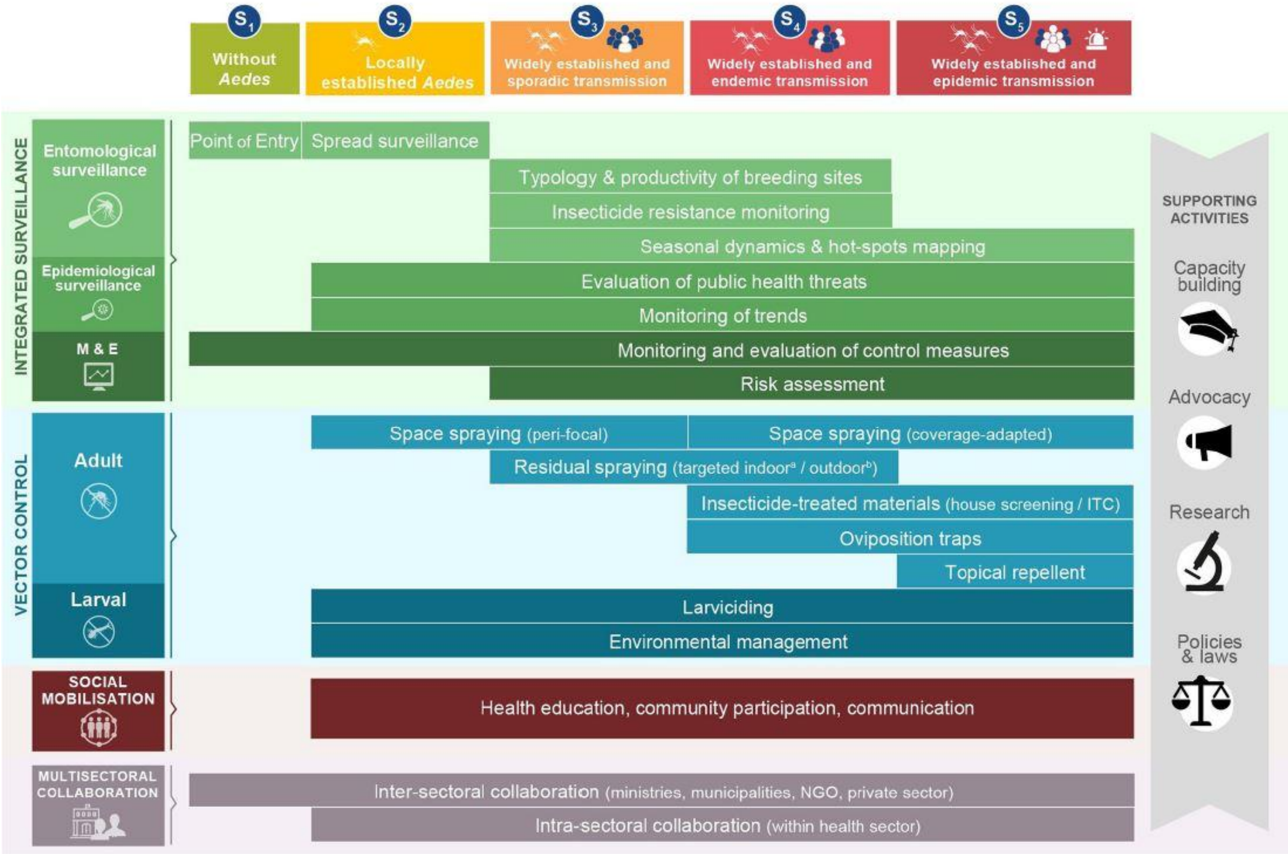
ACTIONS TAKEN and ACTIONS TO BE TAKEN

Actions already taken	Actions to be taken	By whom
	Elaboration of a "**National Action plan" for the prevention and control of *Ae. Albopictus***"	Coordination by NEHAP ?
Surveillance of exotic mosquitoes in Belgium through MEMO+, but limited budget and limited number of field visits	**Sustainable entomological surveillance** - Allocate sufficient funding for the entomological surveillance (active and passive), with adaptations according to the evolution of the situation	Regional health and environmental authorities
Surveillance of dengue, chikungunya and Zika (data NRC arboviruses and mandatory notification)	Enhanced surveillance during mosquito season in areas with *established Ae. albopictus* - Exhaustive and timely (real time) reporting of imported or autochthonous cases from NRC to regional health authorities is needed, as currently data transmission to Sciensano is only yearly	NRC + Regional health authorities
	Urgently make all cases of dengue, chikungunya and Zika mandatory notifiable in the four federated entities – as currently, they are notifiable only if acquired in Europe	Regional health authorities
	Setting up of a working group to prepare a secure mechanism for the data linkage and sharing	Coordination by Sciensano ?
Control is being performed in some locations where *Ae. albopictus* has been found	Explore availability of other biocides and alternative products for vector control in Belgium	Regional environmental authorities
	Perform a quantitative assessment identifying areas potentially more vulnerable for local transmission	ITM and Sciensano
	Explore possibility of rapid diagnostic capacity in Belgium as a scale-up strategy in the event of an outbreak	NRC

Yearly communication campaigns on the entomological surveillance (press releases, annual report, social media)	Further increase the visibility of the passive surveillance, including specific target groups	Sciensano
	Enhanced communication around *Ae. albopictus* and Aedes borne diseases – - Create greater awareness in the general public - Increase awareness among GPs and other physicians	Regional health authorities

Annex II: Integrated *Aedes* management (IAM) system

Integrated *Aedes* management (IAM) system (Roiz et al. 2018)
This framework offers decision-making guidance based on available evidence of effective control of *Aedes* at different levels of infestation and virus transmission risk.



Annex III : Events of dengue virus transmission since 2010 in Europe

Year	Country	Department or regions affected	Number of autochthonous cases	Probable period of virus circulation
2010	Croatia	Korčula Island and the Pelješac peninsula	10	August–October
2010	France	Alpes-Maritimes department	2	August–September
2013	France	Bouches–du-Rhône department	1	September-October
2014	France	Var and Bouches-du-Rhône departments	4	July-September
2015	France	Gard department	8	July–September
2018	France	Alpes Maritimes, Hérault, and Gard departments	8	September–October
2018	Spain	Catalonia region, Murcia region or province of Cádiz	6	August-October
2019	Spain	Catalonia region	1	September
2019	France	Alpes-Maritimes and Rhône departments	9	July-September
2020	France	Hérault, Var, Alpes-Maritime, and Gard departments	13	July-October
2020	Italy	Veneto region	10	August
2021	France	Var and Hérault departments	2	July and September
2022	France	Pyrénées-Orientales, Hautes-Pyrénées, Haute-Garonne, Tarn et Garonne, Var, Alpes-Maritime, and Corsica departments	65	June- September
2022	Spain	Ibiza	6	August-October
2023	France	Île-de-France (1 case), Bouches–du-Rhône (13 cases in 2 clusters), Pyrénées-Orientales (11 cases, 1 cluster), Gard (8 cases, 1 cluster), Alpes-Maritimes or Var (1 case) and Auvergne Rhône-Alpes (2 cases, 1 cluster) departments	43	July-September

Year	Country	Department or regions affected	Number of autochthonous cases	Probable period of virus circulation
2023	Italy	Lodi (36 cases), Rome (28 cases) and Latina (2 cases) provinces.	66	End of July-October
2023	Spain	Catalonia (2 cases)	3	August-October

*The table combines information published in official reports and in the scientific literature plus information that was provided by the public health institutes and/or the ministries of health in the affected Member States.*https://www.ecdc.europa.eu/en/all-topics-z/dengue/surveillance-and-disease-data/autochthonous-transmission-dengue-virus-eueea

Annex IV: Events of Chikungunya virus transmission in Europe.

No events of autochthonous transmission were reported in the EU/EEA since 2017. (Source : ECDC)

Year	Country, region, municipalities	Number of autochthonous cases	Period of circulation (probable)	Origin of the primary travel-related case (probable)	Virus	Presence E1-A226V
2007	Italy, region of Emilia Romagna, (main transmission areas in Castiglione di Cervia and Castiglione di Ravenna)	≈ 330 suspected, probable and confirmed	July–September	India	CHIKV ECSA	Yes
2010	France, Var department, Fréjus	2	September	India	CHIKV ECSA	No
2014	France, Hérault department, Montpellier	12	September–October	Cameroon	CHIKV ECSA	Yes
2017	France, Var department, Le Cannet-les-Maures and Taradeau	17 (11 in Cannet-des-Maures and 6 in Taradeau)	July–September	Central Africa	CHIKV ECSA	Yes
2017	Italy, Lazio region (Anzio, Latina and Roma) and Calabria region (Guardavalle marina)	270 confirmed and 219 probable	August–November	Asia (India/Pakistan)	CHIKV ECSA belonging to a branch of Indian Ocean Lineage (IOL) reported from Indian subcontinent (India, Pakistan)	No

HIKV ECSA: Chikungunya virus East/Central/South African lineage.
E1-A226V: CHIKV envelope protein 1 with alanine to valine substitution at position 226.
The table combines information published in official reports and in the scientific literature plus information that was provided by the public health institutes and/or the ministries of health in the affected Member States.
https://www.ecdc.europa.eu/en/infectious-disease-topics/z-disease-list/chikungunya-virus-disease/surveillance-threats-and

Annex V: Result of the expert consultation on scoring/prioritisation of recommendations made for the risk assessment

Response ID	Make a "National Action plan" for the prevention and control of Ae. albopictus and Aedes borne diseases"	Set up a mechanism for the exchange and linkage of relevant data such as cases of MBD from mandatory notification, laboratory results and entomological data in order to facilitate communication and management	Make a fine-scale quantitative assessment using e.g. a modelling approach to have a better overview of areas potentially more vulnerable for local transmission	Maintain and enhance entomological surveillance (active and passive), allocation of suffiicient and sustainable funding (not project base)	Adapt the monitoring to the evolution of the Ae. albopictus situation in Belgium, allocating enough funding for this adaptation	Ensure monitoring of introduction (new locations), but also spreading, overwintering and efficacy of control (when control is made)	Enhance the surveillance of dengue, chikungunya and Zika during the mosquito season (including exhaustive and timely reporting of all cases and investigation/control measures around imported cases in areas where the vector is present)
1	3	2	1	3	3	3	3
2	3	3	2	3	3	3	3
3	3	2	2	3	2	2	3
4	2	3	1	3	3	3	2
5	3	3		3		3	2
6	3	3	2	3	2	3	2
7	3	3	2	1	3	3	3
8	3	2	2	3	2	3	2
9	2	3	1	2	3	3	3
10	2	3	1	2	3	3	3
11	3	2	1	1	3	2	3
12	3	3	2	3	3	3	3
13	3	3	3	3	3	3	3
14	2	3	3	3	2	3	3
15	3	3	2	3	3	3	3
16	3	0	0	0	0	0	0
17	2	3	2	2	3	2	3
18	3	3	3	3	3	3	2
TOTAL	49	47	30	44	44	48	46

Response ID	Explore the possibilities of deploying diagnostic capacity in Belgium to be ready to face the need of rapid diagnosis if diseases become autochthonous	Further strengthen the passive surveillance by giving as much visibility as possible to the citizen science website, in order to have as much notifications as possible.	Engage specific students groups (e.g. agro, biology, etc..) and other relevant people in the citizen surveillance.	Create greater awareness among the general public around Ae. albopictus (i.e. its potential to transmit diseases and most important prevention measures (i.e. how to decrease the mosquito population)).	Have a website with centralised information around Ae. albopictus (i.e. a point where all information relating to the epidemiological situation and vector dispersal can be found, with links to regional health platforms for any specific procedures and EU for imported cases)	Increase awareness among GPs and other physicians (e.g. hospitals) about the current public health threat during the mosquito season	Explore possibilities for use of other biocides for vector control as there are currently some legal limitations for the use of some biocides, reducing the possibilities of choice of treatments	Explore and investigate other possibilities of vector control (i.e. biological control (biodiversity/native species that can compete with Ae. Albopictus ; use of treatment by private people and not only through companies)
1	1	3	2	3	2	2	3	2
2	2	3	2	3	2	2	2	2
3	2	1	1	3	3	3	2	2
4	2	3	2	3	2	2	2	3
5	1	2	2	1	1	2	2	2
6	3	2	2	2	2	2	2	2
7	3	3	1	2	2	3	3	3
8	2	1	1	1	1	2	2	2
9	2	3	1	3	1	2	3	1
10	1	3	1	3	1	2	3	1
11	1	2	1	3	3	2	3	3
12	2	2	2	3	2	3	0	2
13	3	3	2	3	3	3	3	3
14	2	3	2	3	3	3	2	3
15	3	2	2	2	3	3	2	2
16	0	0	0	0	0	0	0	0
17	1	2	2	2	1	1	2	3
18	2	3	2	3	1	3	3	3
TOTAL	33	41	28	43	33	40	39	39