Bundesinstitut für Öffentliche Gesundheit

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Mosquitoes: Recognition, Prevention, Action

Understanding the risks in the face of climate change and preventing infections

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Mosquitoes – just a nuisance, or are they dangerous too?

Mosquitoes can be a real nuisance, especially in summer. They buzz in your ear at night, keep you awake and bite.

In Germany, these bites are usually harmless, but they can cause severe itching and become infected. **Under certain circumstances, some mosquito species can also transmit various pathogens, including the West Nile, chikungunya and dengue viruses.** The risk of transmission is also rising in Germany due to increasingly warmer seasons resulting from climate change, as well as global travel.

This leaflet provides information on the risks of infection and possible diseases, as well as on effective protection against mosquito bites.

Interesting facts about mosquitoes

- Mosquitoes belong to the insect family.
- There are around 50 different mosquito species in Germany. Two of the most common native species are the **common house mosquito *(Culex pipiens)*** and the banded mosquito ***(Culiseta annulata)***.
- Mosquitoes locate humans by detecting body heat, moisture, exhaled carbon dioxide and body odour.
- Only female mosquitoes bite: They need a blood meal in order to produce eggs.
- The development from egg to adult mosquito **always** takes place in water. Even small accumulations of water, such as those in flowerpot saucers or puddles, are sometimes enough for them to lay their eggs.
- Most **native mosquito species bite** mainly at dusk and at night.
- Among the 'invasive' species that have migrated to Germany, the **Asian tiger mosquito *(Aedes albopictus)*** is of particular concern. It bites even during the day.

Common native mosquito species

A mosquito of the genus *Culex*, viewed from the side (a) and from the front (b): The abdominal segments are dark brown with white stripes. Measuring between 3 and 7 mm in length, it is similar in size to the Asian tiger mosquito. However, the characteristic markings on the head, thorax and legs are missing (see illustrations on page 5).

Banded mosquito *(Culiseta annulata)* viewed from above (c) and from the side (d): **It is often mistaken for the Asian tiger mosquito.** Its white-banded legs and pale transverse stripes on its greyish-brown abdomen make it very similar in appearance to the Asian tiger mosquito. However, at 10-13 mm in length, it is significantly larger. It also lacks the characteristic markings on the head and thorax (see illustrations on page 5). The banded mosquito is not a significant vector of tropical pathogens.

The Asian tiger mosquito

The **Asian tiger mosquito *(Aedes albopictus)*** is currently spreading in Germany. It originates from East Asia and has spread to many parts of the world, including Europe, as a result of international travel and trade. It was first recorded in Germany in 2007. It is now found year-round, particularly in the south-west of the country – for example, along the Rhine – as well as in certain areas further north, such as Berlin.

The Asian tiger mosquito is usually active during the day. It is relatively small, measuring around 4 to 8 mm. Furthermore, it has a distinctive marking: Its body is deep black, with conspicuous white stripes on the body and legs. A silvery-white line runs centrally across the head and thorax.

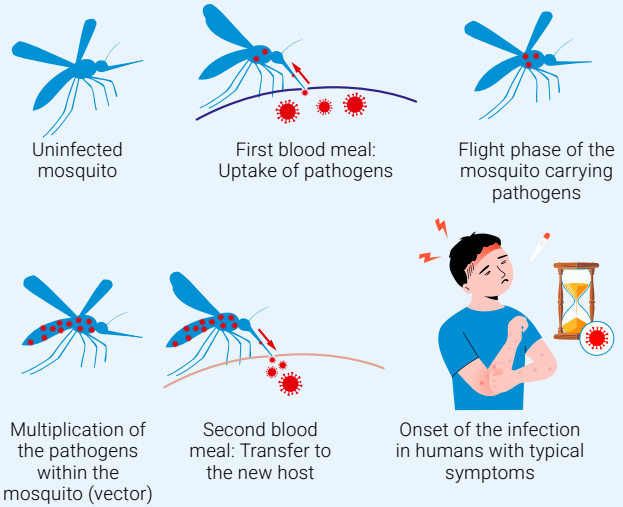
Asian tiger mosquito *(Aedes albopictus)* viewed from the side (a) and from the front (b): It measures approximately 4 to 8 mm. A silvery-white line runs down the centre of the head and continues onto the thorax. This marking is the most reliable feature for identifying the Asian tiger mosquito.

A map showing the distribution of the tiger mosquito in Germany can be found on the Friedrich Loeffler Institute's (FLI) website at: https://www.fli.de/en/commissions/national-expert-group-mosquitoes-as-vectors-of-disease-agents/

The Asian tiger mosquito can transmit pathogens such as the dengue virus, the chikungunya virus or the Zika virus to humans. **However, no such transmissions have yet been observed in Germany.** For this to happen, various conditions must be met (see the section Could tropical pathogens be transmitted in Germany in the future?, page 21). **Nevertheless, it is important to prevent the Asian tiger mosquito from spreading further in Germany wherever possible, or to contain its expansion in areas where it is already established.**

How do mosquitoes transmit diseases?

Not all mosquitoes carry pathogens. They only become carriers if they have previously bitten an infected host (e.g. a bird or a human) and acquired the pathogens from its blood. The pathogens multiply inside the mosquito's body and migrate to its salivary glands. They can then be transmitted to a new host, such as a human, during the next blood meal. Organisms that can transmit pathogens in this way are known as **vectors**.



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What is the risk of infection from mosquitoes in Germany?

Worldwide, mosquito-borne diseases pose a major health risk. Such conditions have so far **been very rare** in Germany. They usually affect travellers returning from tropical or subtropical regions who have contracted the disease there.

To date, the West Nile virus has been the most significant pathogen transmitted by native mosquitoes in Germany.

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The West Nile virus

The West Nile virus is a pathogen that can be transmitted in Germany by various mosquito species, including the common house mosquito *(Culex pipiens)*. The virus causes what is known as **West Nile fever**.

The virus originated in Africa and was spread worldwide mainly by migratory birds. Outbreaks among birds have been occurring regularly in Germany for several years now. The virus has also been detected in infected horses. Since 2019, there have been isolated cases each year of people becoming infected after being bitten by mosquitoes here during the height of summer. This applies in particular to areas in eastern and northern Germany, where the virus also overwinters. People who have been infected abroad do not play a role in the further transmission of the West Nile virus in Germany.

A map showing the distribution of the West Nile virus can be found on the Friedrich-Loeffer-Institut (FLI) website at: www.fli.de/en/news/animal-disease-situation/west-nile-virus

After being infected with the West Nile virus, most people experience no symptoms or only mild ones. Around 20 out of every 100 people infected develop flu-like symptoms such as fever, fatigue, headache and aching limbs. In about half of those affected, a pale, widespread skin rash also develops.

Around one in 100 infected people develop severe symptoms. This can lead to inflammation of the brain or the meninges. **Older people, as well as those with underlying health conditions or a weakened immune system, are at increased risk of developing severe symptoms.** These groups of people should take particular care to protect themselves from mosquito bites during the height of summer if they are in a high-risk area.

There is currently no vaccine against the West Nile virus for humans.

Further information on West Nile fever can be found here: https://www.infektionsschutz.de/en/infektionen/erregersteckbriefe/west-nile-fever/

What other major mosquito-borne diseases are there worldwide?

In addition to West Nile fever, other viral diseases transmitted by mosquitoes worldwide include chikungunya fever, dengue fever and Zika fever. **These diseases are primarily prevalent in tropical and adjacent subtropical regions.** Therefore, individuals planning to travel to these areas should seek medical advice beforehand and obtain any recommended vaccinations.

While many of these infections are mild or remain asymptomatic in most cases, severe courses of disease may occur in rare cases. Typical symptoms include flu-like symptoms such as **fever, headache and aching limbs, as well as a general feeling of malaise**.

Chikungunya fever

- Other possible symptoms: skin rashes and severe joint pain, which can last for months or even years
- Protection: Taking consistent measures to protect yourself from mosquito bites can greatly reduce the risk of disease. A vaccination may be available for travellers under certain circumstances

Dengue fever

- Other possible symptoms: severe muscle and joint pain, swollen lymph nodes, skin rash
- Notable feature: Severe cases are very rare
- Protection: Here too, consistent use of mosquito repellent can help reduce the risk of contracting the disease. Vaccination is only recommended under certain circumstances when travelling.

Zika virus

- Other possible symptoms: conjunctivitis, skin rash
- Notable feature: The Zika virus can be transmitted to the unborn child during pregnancy and cause birth defects.
- Couples planning a pregnancy should be aware that men returning from travel who are infected but often asymptomatic can transmit the infection sexually to female partners who have not travelled.
- Consistent mosquito protection. There is currently no vaccine available.

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For yellow fever (a viral disease) and malaria (a parasitic disease), both of which are endemic exclusively to tropical regions, severe illness and death are common outcomes. Here too, flu-like symptoms such as **fever, headache and aching limbs, as well as a general, often severe feeling of illness**, are typical. Malaria is transmitted by a nocturnal mosquito *(Anopheles)*, so mosquito bite prevention should focus on the evening and the night-time hours.

Yellow fever

- Other possible symptoms: nausea, vomiting, and possibly nosebleeds
- Consistent mosquito protection. A **vaccine** is available.

Malaria

- A severe feeling of illness. Other possible symptoms: In some forms of malaria, bouts of fever alternate with fever-free periods
- Not all forms of malaria are equally dangerous. Most deaths are caused by 'malaria tropica'.
- Protection: Take consistent precautions against mosquitoes, especially in the evening and at night (mosquito net). When travelling to high-risk areas, it may also be advisable to take specific medication as a preventive measure **(medication-based prophylaxis)** following consultation with a doctor.
- There is no vaccine against malaria in Germany. Malaria vaccines are currently used mainly in various African countries as part of childhood vaccination programmes.

Ideally, you should consult your family doctor or a travel medicine clinic to find out about appropriate preventive measures and recommended vaccinations before travelling to tropical or subtropical regions. A list of travel and tropical medicine advice centres can be viewed here: www.dtg.org/liste-tropenmedizinischer-institutionen

As a general preventive measure against mosquito-borne diseases, there are currently no plans to offer vaccinations to the general public in Germany. As the risk of transmission of the relevant pathogens is very low in Germany, the available vaccines are not generally recommended. They are only usually recommended for travellers visiting areas where these pathogens are more prevalent.

Note: When travelling in countries or regions with warm to hot and humid climates, such as tropical and adjacent subtropical areas, you may become infected with pathogens, potentially without experiencing any symptoms, and thereby bring viruses such as dengue, chikungunya or Zika back to Germany in your blood. **You can help prevent the disease from spreading within Germany by taking particular care to protect yourself from mosquito bites during the first two weeks after returning from your trip.** This is particularly important in summer and especially in areas where the Asian tiger mosquito has already become established.

The most important and effective way to protect yourself against mosquito-borne diseases is to avoid being bitten by mosquitoes!

How can I protect myself from mosquito bites?

Avoid breeding grounds: Mosquitoes lay their eggs in standing water. You should therefore regularly change the water in flower saucers, watering cans and the like in your local environment, and cover rain barrels securely with nets. Ornamental ponds are made safe by introducing fish. Keep your gutters clean. Standing water can also be breeding grounds on higher floors.

Covering the body: Wear long, loose-fitting clothing made from tightly woven, light-coloured fabrics such as cotton, linen or technical fabrics. Mosquitoes can bite through thin or tight-fitting fabrics.

Using insect repellent: Insect repellents with proven efficacy, such as products containing DEET or icaridin, should be applied thinly to exposed skin (over sunscreen). Always follow the age restrictions and instructions for use.

Creating barriers: Fit fine-mesh insect screens to your windows. In addition, or as an alternative, mosquito nets that are securely fastened above the bed provide protection, particularly at night.

Please note the following regarding personal hygiene: Take regular showers and change out of sweaty clothes, as sweat and body odour can attract mosquitoes.

Avoid active times: Many native mosquito species are most active at dusk and dawn. During this time, try to stay indoors as much as possible, or protect yourself with nets, clothing or insect repellents.

UV light traps, ultrasonic devices, repellent wristbands, eating garlic, citronella candles and tea-tree oil **have little or no proven effectiveness against mosquitoes**.

What should I bear in mind after being bitten by a mosquito?

A mosquito bite usually causes a harmless skin reaction. The injection site swells slightly, turns red and itches. This is caused by an immune response to certain substances in the mosquito's saliva.

Cooling gels or ointments containing suitable active ingredients can help relieve the symptoms. Applying targeted heat (e.g. using a heat pad) followed by cooling can also help to relieve the itching and soothe the skin.

Important: Try not to scratch yourself. Scratching can allow dirt and germs to penetrate the skin and cause inflammation. The affected area then swells up considerably, feels warm, becomes reddened and may be painful.

Seek medical advice if you notice any signs of inflammation. You should also seek medical advice if you develop a fever or experience unexplained symptoms following a long-distance journey.

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How does climate change affect mosquitoes?

Higher temperatures in summer allow mosquito populations to grow more rapidly, leading to more frequent bites. At the same time, the period of the year during which they are active is extended. In **milder winters**, some species of mosquito – or rather their eggs and larvae – are particularly well able to overwinter in Germany. **Invasive species** such as the **Asian tiger mosquito** find even more favourable living conditions in Germany as a result of global warming.

At the same time, many people spend more time outdoors when the weather is warm. This increases the risk of being bitten. The processes required for the transmission of mosquito-borne **pathogens** – namely the multiplication of the pathogens within the mosquito's digestive tract and their subsequent migration to the salivary glands – become more efficient as temperatures rise. Warmer summer temperatures and longer summers therefore favour the transmission of these pathogens.

For further information on the impact of climate change on mosquitoes and how you can effectively protect yourself against bites, please visit www.klima-mensch-gesundheit.de/schutz-vor-zecken-und-muecken/.

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How can I reduce the number of mosquitoes in my immediate surroundings and limit the spread of invasive mosquitoes?

Mosquitoes lay their eggs in standing water. For some species, even the smallest collections of water are sufficient to produce hundreds of mosquitoes. Avoiding such breeding sites in gardens, on balconies and around homes can significantly reduce their spread.

- Regularly remove standing water from containers such as plant saucers, bird baths and flower vases, ideally at least once a week.
- Always store watering cans or buckets upside down after use to prevent water from collecting.
- Stock ornamental ponds with fish.
- Keep gutters clear and clean to prevent standing water from accumulating.
- Cover rain barrels tightly with a net.

In areas particularly affected, biological or chemical agents may also be used. Further information on this subject is also available from the Municipal Action Group for Combating the Mosquito Plague (Kommunale Aktionsgemeinschaft zur Bekämpfung der Schnakenplage e.V.). (KABS): www.kabsev.de

Also, make sure you don't bring any mosquitoes back with you in your car or motorhome from southern Europe or southern Germany.

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The close-up shows mosquito larvae in the first (centre) and fourth (left) instars, as well as a pupa (right). Female common house mosquitoes lay their eggs in the form of 'floating clusters' (clusters of around 200-400 eggs) directly on the water's surface. The eggs hatch into larvae, which pass through four larval instars and a pupal stage before developing into winged adults. They obtain their oxygen from the air via a breathing tube located on their abdomen. Using their mouthparts, they create water currents and filter tiny particles, such as dead microorganisms and suspended matter, from the water to use as food. The time it takes for a mosquito to develop from an egg to an adult depends largely on the water temperature. Depending on the temperature, this process can take from a few days to several weeks.

The **Mosquito Atlas** (mueckenatlas.com) is a participatory initiative for citizens. You can send in any mosquitoes you have caught; they will then be identified and recorded on a map. By doing this, you will help us to better track the spread of various mosquito species in Germany.

What should I bear in mind before travelling abroad?

You can find information on health risks in your destination country on the Foreign Office website. Before travelling long-haul to a high-risk country, you should seek medical advice. You can also find information there on recommended vaccinations and other protective measures.

Could tropical pathogens be transmitted in Germany in future?

To date, there are no known cases of tropical pathogens such as the dengue, Zika or chikungunya viruses being transmitted to humans in Germany via mosquitoes. In southern Europe, however, such transmissions have become increasingly common in the height of summer in recent years, for example in France and Italy.

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For certain pathogens, such as the dengue and chikungunya viruses, to be transmitted, various conditions must be met:

1. A person becomes infected abroad and brings the virus back to Germany.
2. A suitable mosquito species (e.g. the Asian tiger mosquito) bites the person whilst the virus is still present in their blood. This is usually only the case for a few days.
3. The virus multiplies inside the mosquito, which generally requires high outdoor temperatures.
4. The mosquito lives long enough to bite another person

These conditions currently occur simultaneously only very rarely in Germany. However, experts believe that climate change will bring about a change in this situation in the future. In some regions of Germany, conditions are already favourable for the **Chikungunya virus**, particularly during the summer.

Good to know

Malaria has not been prevalent in Germany since the 1950s. Nevertheless, there are a few Anopheles mosquitoes living here that are capable of transmitting the pathogens. The disease occasionally breaks out in Germany amongst people returning from abroad. It is important to treat the disease at an early stage to prevent the spread of malaria.

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Further information

- www.infektionsschutz.de
- www.rki.de
- www.klima-mensch-gesundheit.de
- www.auswaertiges-amt.de

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