Center for Water Quality Research
Institute for Environmental Research

An Environmental Guide for Dengue Fever Vectors Control

Contents

Dengue

Dengue fever is a viral illness, also known as Dengue fever or Dang fever, and due to the severe pain it causes, it is sometimes referred to as "break bone fever." The virus responsible for this disease is transmitted to humans through a mosquito called Aedes.

Global Spread

The incidence of dengue has increased dramatically worldwide in recent decades, with reported cases to the WHO rising from 505,430 in 2000 to 2.5 million in 2019. The disease is widespread in tropical and subtropical regions around the world, including parts of Asia, Africa, the Americas, and the Western Pacific. Currently, about half of the world's population is at risk of contracting dengue, with an estimated 100 to 400 million cases annually. Dengue fever is endemic to many tropical and subtropical regions globally, with its presence reported across various continents:

Asia: Including Southeast Asia, South Asia, and parts of East Asia.

Africa: Especially in tropical and subtropical regions.

Americas: Including Central and South America, and parts of the Caribbean.

Western Pacific: Including Oceania and parts of Southeast Asia.

Dengue Fever in Iran

This disease is more prevalent in Iran's neighboring countries, including Pakistan and some Gulf states. Dengue fever continues to be a public health concern in Iran as well. Currently, the Aedes aegypti mosquito is found in the Hormozgan, Sistan and Baluchestan (Chabahar and Konarak), and Bushehr (Assaluyeh and

Kangan) provinces, while the Aedes albopictus mosquito is spreading in Gilan province.

According to the current syndromic surveillance system report in the country, as of July 3, 2024, more than 122 confirmed cases of dengue fever have been diagnosed since the beginning of 2024. Epidemiological investigations show that most cases were contracted in the United Arab Emirates. At the same time, six patients were diagnosed in Bandar Lengeh without any history of foreign travel, indicating local transmission. Currently, the Aedes aegypti mosquito is found in the provinces of Hormozgan, Sistan, and Baluchestan (Chabahar and Konarak), and Bushehr (Assaluyeh and Kangan), while the Aedes albopictus mosquito is spreading in Gilan province.

For the latest dengue fever updates in Iran, visit the Communicable Diseases Center website of the Ministry of Health and Medical Education at https://icdc.behdasht.gov.ir/outbreak.

Symptoms of the Disease

Dengue fever presents in two forms: mild and hemorrhagic. The range of symptoms varies from mild to severe, sometimes accompanied by bleeding. Most people infected with dengue experience mild symptoms or are asymptomatic and recover within 1 to 2 weeks. Rarely, dengue fever can become severe and lead to death. If symptoms do appear, they usually start 4 to 10 days after infection and last for 2 to 7 days. Symptoms may include:

- High fever (40°C / 104°F)

- Severe headache and pain behind the eyes
- Muscle and joint pain
- Nausea
- Vomiting
- Swollen glands
- Rash

In severe cases of dengue (dengue hemorrhagic fever), symptoms may include severe abdominal pain, persistent vomiting, bleeding from the gums, difficulty breathing, and a significant drop in platelet count, which, if not treated promptly, can lead to severe complications and even death.

Figure 1: The prevalence of dengue fever in eastern neighboring countries

Dengue Vectors

The disease is primarily transmitted to humans by Aedes mosquitoes: **Aedes aegypti** and **Aedes albopictus.** Dengue fever is not transmitted from person to person but is spread to humans through mosquito bites. The mosquito itself does not cause the disease; rather, it becomes infected by biting an infected person, and then transmits the virus to another person through its bite, leading to the onset of the disease. If a mosquito infected with the virus enters an area and reproduces, the disease can become endemic.

Aedes aegypti: This mosquito is well-adapted to urban environments and typically bites during the day, with peak biting times in the early morning and late afternoon. Currently, Aedes aegypti has been identified in the provinces of Hormozgan, Sistan, and Baluchestan (Chabahar and Konarak), and Bushehr (Asaluyeh and Kangan). Aedes aegypti prefers to feed exclusively on human blood.

Aedes albopictus: Also known as the Asian tiger mosquito, this species can also transmit the dengue virus, although its role in transmission is less significant than that of Aedes aegypti. Aedes albopictus has been identified in the province of Gilan.

Figure 2: Aedes mosquito (observe the white lines on the thorax and striped legs)

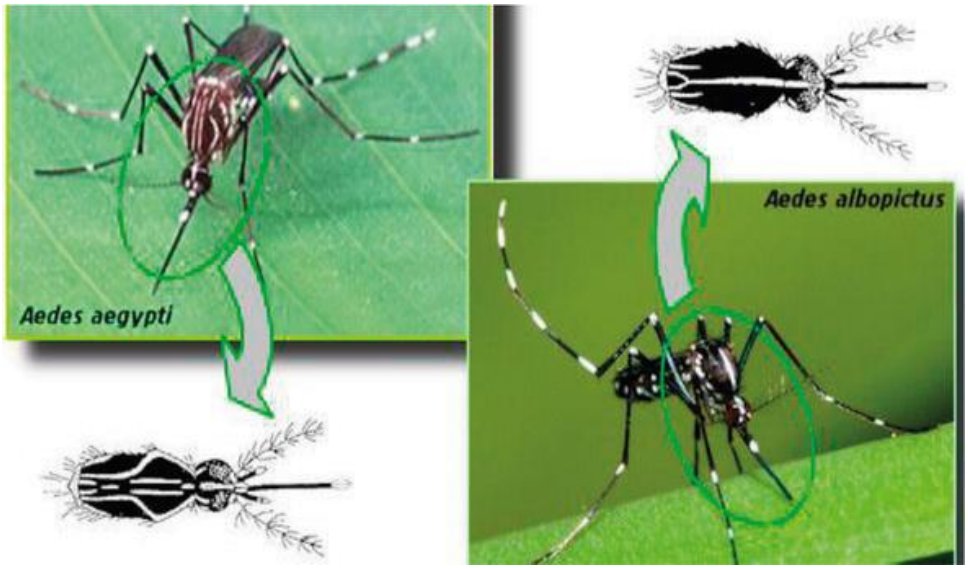

Figure 3: The difference in the appearance of Aedes albopictus mosquito (one white line on the back of the thorax) and Aedes aegypti (two white lines on the back of the thorax)

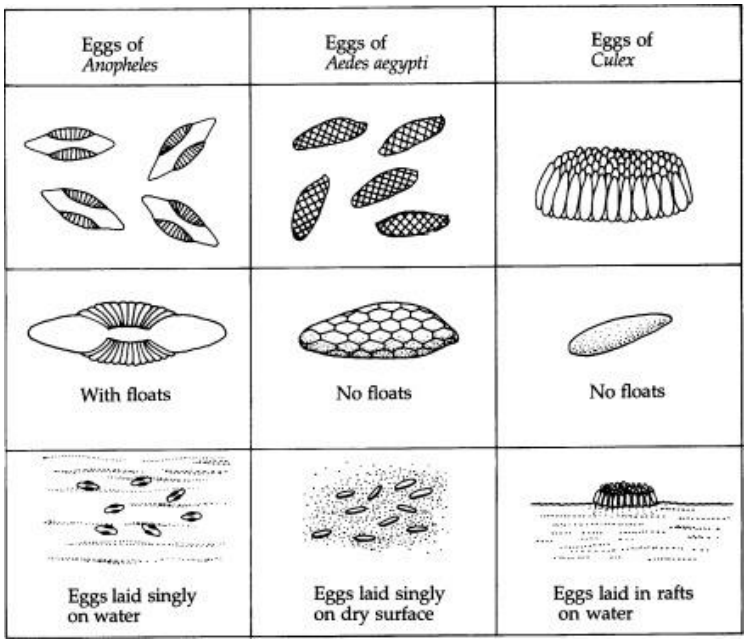

Figure 4: Comparison of egg shapes of Culex (common house mosquito), Aedes, and Anopheles (malaria mosquito)

Public Awareness for Dengue Prevention

Since no successful vaccine has been developed for dengue fever so far, the best way to prevent the disease is to avoid being bitten by Aedes mosquitoes. Therefore, public awareness of the environmental conditions that favor mosquito growth and reproduction, as well as educating the public on how to reduce exposure to mosquito bites, are essential components in reducing the transmission and spread of dengue in the community.

Favorable Environmental Conditions for Mosquito Growth and Reproduction

Aedes mosquitoes lay their eggs and reproduce in stagnant water found in various environments. These locations can primarily include stagnant water in containers such as flower pots, saucers under pots, outdoor water storage containers, and discarded tires holding stagnant water, clogged gutters, and similar areas. Aedes mosquitoes can lay eggs and reproduce even in small amounts of stagnant water. Under favorable environmental conditions, mosquitoes typically need about seven days to complete their reproduction cycle.

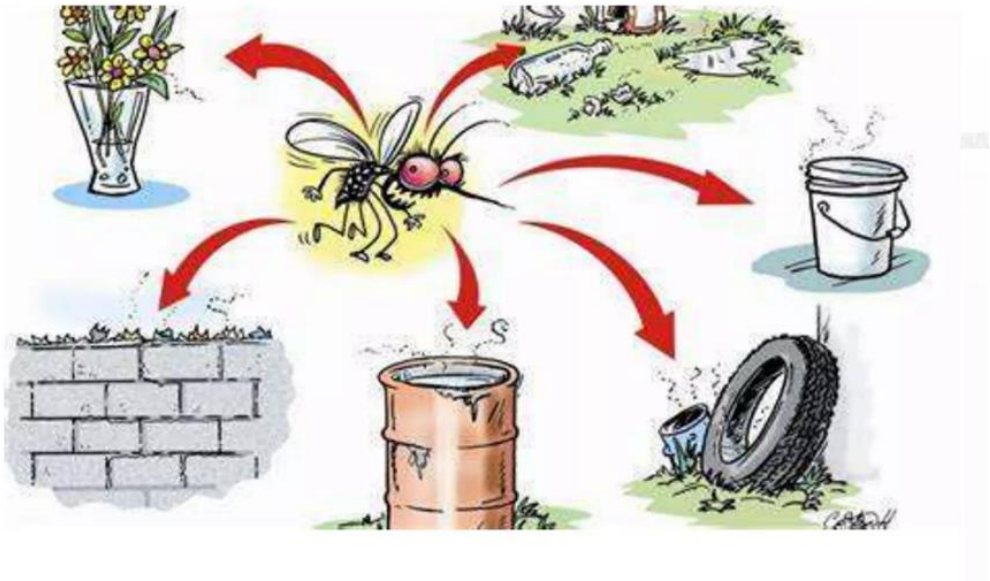

Figure 5: Suitable places for Aedes mosquito growth and reproduction

Water + 7 days = Mosquito

Factors Influencing the Spread of Dengue Fever

Several factors contribute to the spread of dengue fever:

Weather conditions: Warm, dry climates, particularly during summer, provide ideal breeding grounds for Aedes mosquitoes, especially following rainfall that creates stagnant water in discarded containers like cans and tires.

Urban management: Rapid urbanization, poor waste management, and inadequate sanitation in some areas contribute to the creation of environments favorable for mosquito breeding, such as stagnant water accumulation and waste seepage in urban settings.

Migration and travel: The movement of people across borders with neighboring countries where dengue is endemic can introduce the virus to new areas, aiding local transmission.

Water management: Improper use and storage of water, both on a large scale and at the household level, can lead to the accumulation of stagnant water, creating favorable environmental conditions for mosquito breeding.

Mosquito Life Cycle

Aedes mosquitoes, particularly Aedes aegypti and Aedes albopictus, are vectors for diseases like dengue, Zika, and chikungunya. Their life cycle includes several stages, and implementing environmental health measures at each stage can help prevent their reproduction.

Egg stage: Adult, female mosquitoes lay eggs on the inner walls of containers with water above the waterline, Mosquitoes only need a small amount of water to lay eggs. Bowls, cups, fountains, tires, barrels, vases, and any other container

storing water make a great “nursery. Aedes mosquitoes can lay multiple batches of eggs throughout their lifespan (from weeks to months).

Larval Stage

- After being exposed to water, the eggs hatch into larvae within 1 to 2 days.
- The larvae, commonly known as "wigglers," live in water and feed on organic matter and microorganisms. As they grow, they undergo several molting stages (shedding their outer exoskeleton)

Pupal Stage

- After the larval stage, the mosquito enters the pupal stage, a non-feeding stage.
- Pupae float on the water's surface, where they do not actively feed but transform into adult mosquitoes.
- This stage lasts several days, during which the transformation into an adult mosquito occurs inside the pupal casing.

Adult Mosquito Stage

- After completing this stage, the adult mosquito emerges from the pupal casing on the water's surface.
- The adult mosquito remains on the water's surface for a short time to allow its body and wings to dry and harden so it can begin to fly.
- Once fully developed, the adult mosquito moves away from the water source in search of a host for blood-feeding (by the female mosquito) or nectar-feeding (by the male mosquito).
- Female Aedes mosquitoes require blood meal to lay their eggs.
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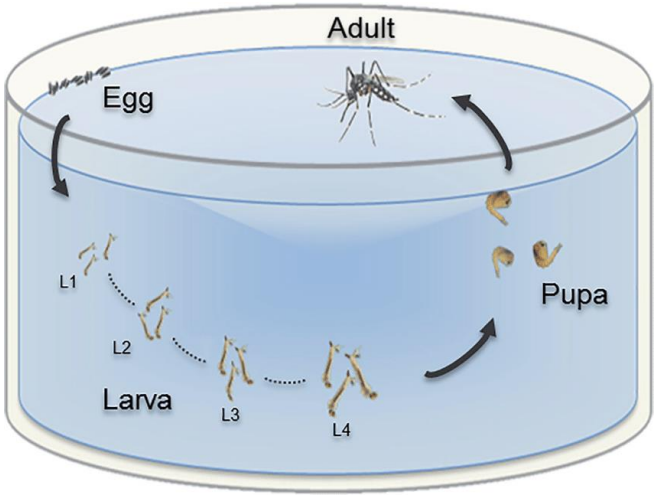

Figure 6. The Aedes mosquitoes' four life stages: egg, larva, pupa and adult

Figure 7: Larvae live in the water.

Environmental Health Measures of Aedes mosquitoes at Home

- To prevent mosquito breeding and reduce the risk of dengue transmission:
- Dry or remove stagnant water: Regularly empty and clean all containers that can hold water (such as flower pots, buckets, broken dishes, used tires, etc.), or cover them. Especially after rainfall, empty any stagnant water that has been collected in containers.
- Keep gutters clean: Ensure that gutters are not blocked to allow for proper drainage of rainwater.
- Dispose of waste properly: Avoid littering and dispose of waste correctly to prevent the creation of potential areas for water and leachate accumulation.
- Do not leave used tires in open areas: Used tires provide a good habitat for Aedes mosquitoes.
- Collect containers: Given the mosquito's preference for laying eggs in containers such as metal cans, used tires, buckets, plastic containers, and similar items, gather any of these containers found in the environment or around the home.
- Empty and clean plant saucers and pet water containers daily.
- Clean gutters, downspouts, roofs, etc., to remove leaves and other debris that may create a place for stagnant water to accumulate.
- Change the water used for livestock and birds, as well as children's splash pools, at least once a week.
- Holes and crevices in tree stumps often hold water; drain them or fill them with sand or mortar.
- Water gardens in a way that prevents stagnant water from accumulating for more than a few days.

- Fill in or drain depressions left by vehicle tires.
- Having a small pond in the yard or garden, or a decorative pond containing mosquito-eating fish or larvivorous species like Gambusia, can effectively control mosquito populations.
- Ensure that water does not accumulate on the covers used for backyard pools and ponds.
- Avoid leaving the lids of water storage tanks open.
- Use larvicides (according to the label instructions) to eliminate mosquito larvae in large home ponds that are not used for drinking and cannot be covered.
- If you observe stagnant water accumulation due to broken water supply lines, contact the Water Incident Department to report the issue.

Personal Protective Measures to Reduce Exposure to Mosquitoes

To minimize the risk of mosquito bites and dengue infection, consider the following protective measures:

- **Wear protective clothing:** Wear long-sleeved shirts, long pants, socks, and closed-toe shoes to prevent your skin from being exposed to mosquito bites during peak biting times.
- **Use mosquito nets:** Sleep under a mosquito net, especially in areas with high mosquito activity and dengue outbreaks.
- **Use mosquito repellents:** Utilize insect repellent sprays available in Iran, such as Sigal (containing the active ingredient beta-alanine amino acid and natural neem extract) and Arden and DEET (containing the active ingredient diethyl toluamide, calendula flower extract, and eucalyptus).

- **Avoid areas with high populations of adult mosquitoes:** As much as possible, avoid traveling to areas with high adult mosquito populations.
- **Steer clear of shaded areas and places with dense vegetation:** Avoid areas where mosquitoes rest or wait for food.
- **Replace torn screens on windows and doors:** Repair any damaged protective screens on windows and doors.
- **Do not travel to areas where the disease is prevalent:** Avoid traveling to regions where the disease is common during the outbreak season (the warm season).
- **Use air conditioning indoors:** Utilize air conditioning systems within the home.

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Figure 8: Personal protection strategies to reduce exposure to mosquitoes

Environmental Health Measures in the Community

The most effective way to combat Aedes mosquitoes is to control and eliminate suitable breeding sites and larval habitats. Therefore, vector control programs by relevant organizations should focus on removing suitable breeding sites for the vector. Additionally, larviciding at mosquito breeding sites and using insecticides for spraying are other important measures to prevent mosquito reproduction.

Relevant organizations should also implement the following ongoing programs:

- **Provide environmental health education:** To raise public awareness about eliminating mosquito breeding sites.
- **Provide personal hygiene education:** Educate the public about the symptoms of dengue fever, transmission, and preventive measures, including the importance of using mosquito repellents and wearing protective clothing.
- **Establish healthcare infrastructure:** Strengthen healthcare systems to improve timely diagnosis and early management of dengue cases and identify outbreak hotspots.
- **Provide chemical and biological control solutions:** Implement strategies to eliminate Aedes mosquitoes and train specialists to execute these strategies, as well as provide public education through the development of practical and accessible guidelines.
- **Proper water management:** Ensure timely repairs of broken water pipes to prevent the accumulation of stagnant water.
- Implement strategies for managing used tires in cities.

Other General Recommendations

- **Environmental sanitation is one of the most important ways to control disease vectors:** Therefore, do not litter waste, disposable containers, or used tires in nature.
- **Seek medical care:** If you experience symptoms of dengue fever, promptly seek medical care for diagnosis and treatment to prevent complications.
- **Stay informed:** Regular vigilance and preventive measures are key to controlling dengue fever outbreaks.

Emergency Phone Numbers (IRAN)

In case of need and emergencies, you can use the following phone numbers to obtain information and guidance:

Table 1. List of Emergency Phone Numbers

Department name	Phone Numbers
The Center for Management of Communicable Diseases	02181455030
The Disease Surveillance Administration	02181455030
the water emergency	122
The Municipal Management System	137

References

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