Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

The first report of Aedes aegypti larvae in Kazerun County, Fars Province, southwestern Iran

Alireza Zare Karizi
Tehran University of Medical Sciences
Kamran Akbarzadeh
Tehran University of Medical Sciences
Bita Ghaderi
Tehran University of Medical Sciences
Jafar Ebrahimifar
Tehran University of Medical Sciences
Sayena Rafizadeh
Ministry of Health and Medical Education
Zahra Karimi
Tehran University of Medical Sciences
Yavar Rassi
rassiy@tums.ac.ir

Tehran University of Medical Sciences
Bagher Esmaeilpour
Tehran University of Medical Sciences

Short Report

Keywords: Aedes aegypti, Dengue fever, First report, Kazerun, Iran

Posted Date: November 12th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-10722699/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: No competing interests reported.

The first report of *Aedes aegypti* larvae in Kazerun County, Fars Province, southwestern Iran

Alireza Zare Karizi[1,2], Kamran Akbarzadeh[1], Bita Ghaderi[1,2], Jafar Ebrahimifar[1,2], Sayena Rafizadeh [3], Zahra Karimi[1] Yavar Rassi[1,4]*

[1] Department of Vector Biology and Control of Diseases, School of Public Health, Tehran University of Medical Sciences, Tehran, Iran

[2] Student Scientific Research Center, Tehran University of Medical Sciences, Tehran, Iran

[3]Ministry of Health and Medical Education, Tehran, Iran

[4]Arthropod-Borne Diseases Research Center, Ardabil University of Medical Sciences, Ardabil, Iran

***Corresponding author:** Prof. Yavar Rassi, E-mail: rassiy@tums.ac.ir **ORCID**: 0000-0002-2998-6630

Abstract

Background: As the primary vector of dengue and other arboviruses, *Aedes aegypti*, has proliferated throughout the WHO Eastern Mediterranean Region, public health concerns have grown. *Ae. aegypti* populations in Iran have long been thought to be extinct, but recent studies indicates that new introductions have occurred in southern regions.

Aim: The first verified record of *Ae. aegypti* is presented in this paper in Kazerun County, Fars Province.

Methods: As part of the national dengue surveillance program, an entomological survey was conducted in September 2025 using six ovitraps positioned according to national criteria. one ovitrap (16.7 %) in a shaded shelter pit, exhibited an unusually high larval density. For laboratory identification, fifty larvae randomly were selected and reared to the fourth-instar larvae. Morphological examination of the the 4th instar larvae based on abdominal segment features, pecten form, and siphon index identified three specimens (6 %) as *Ae. aegypti*. The remaining larvae were determined to be non-*Aedes* species.

Results: The presence of viable larvae and naturally deposited eggs in semi-arid settings with high ambient temperatures (39 °C) indicates local active breeding. This finding extends the known distribution range approximately 400 km.

Conclusion: The presence of this invasive vector, *Aedes aegypti*,in Fars Province is a critical public health threat, especially considering the recent autochthonous dengue cases, reinforces the critical necessity for intensified entomological surveillanceand intersectoral preparedness.

Keywords: *Aedes aegypti*, Dengue fever, First report, Kazerun, Iran.

Introduction

The *Aedes aegypti* mosquito constitutes one of the most important arthropod-borne disease vectors globally. It severe as the primary vector for several major infectious diseases including dengue fever, Zika virus, chikungunya, and yellow fever (Roiz et al., 2024). Owing to its pronounced arthopophilic feeding behavior and highly efficient adaptation to peridomestic and urban environments, this species readily invades human dwelling and oviposit in in small, stagnant water containers proximal to human habitation including flower pots, water storage drums, and discarded tires (Castro et al., 2017). Collectively, these ecological and behavioral traits have facilitated tits extensive dispersal throughout densely populated regions, thereby elevating the epidemiological risk of associated arboviral disease transmission.

The pathogens transmitted by this vector represent a grave menace not only to worldwide public health but also to financial stability. Currently, nearly 50 % of the global population is vulnerable to dengue fever, a disease that affects 100 and 400 million individuals each year and has witnessed a dramatic surge over the last few decades. In numerous nations across Asian and Latin American, severe manifestation of dengue are leading contributors to hospital admissions and fatalities among children, cementing its status as the fastest-proliferating viral illness in existence today (WHO, 2026). Beyond the detrimental health impacts, these illnesses impose substantial economic burdens; worldwide estimates reveal that the aggregate expense attributed to *Aedes* mosquitoes and the diseases they spread has surpassed at least USD 94.7 billion over the past several decades, underscoring its immense fiscal weight (Roiz et al., 2024).

Despite sporadic reports from Iran's southern coastal regions in the early 20th century, the country had long been considered free of established *Aedes aegypti* infestations. Fallowing several decades without confirmed records, Ae. *aegypti* was officially confirmed as reintroduced in Hormozgan Province in 2019, based on morphological and molecular identification of larval and adult specimens. Subsequent surveillance has documented a progressive spread of this invasive vector across various southern regions of Iran. Until recently, dengue cases in Iran were considered exclusively imported; however, the identification of the first autochthonous dengue transmission event in Hormozgan Province during mid-2024 has provided definitive evidence of sustained local virus circulation following the establishment of the vector, thereby underscoring a burgeoning public health threat (Enayati et al., 2024; Dorzaban etal., 2022).

The objective of the current study is to report the first documented occurrence of *Aedes aegypti* larvae in Kazerun County, Fars Province, southwestern Iran. This is a critical finding that fills a gap in the national vector distribution map and signals a public health threat.

Materials and Methods

Kazerun County (Fig.1) is located in western Fars Province, southwestern Iran, within the Zagros Mountains(29°37′N, 51°39′E), at an elevation of approximately 860 meters above sea level. The region experiences a hot semi-arid climate, characterized by scorching summers and mild winters (8). As part of an training internship, this entomological survey was conducted during early September 2025 at the Kazerun Health Education and Research Station located in Fars Province, southwestern Iran. In Accordance with the national dengue monitoring protocol (9), six ovi-traps made from black plastic containers were deployed at the station, both indoors and outdoors. Each trap was filled with approximately 300 mL of water containing a fermented straw infusion as an oviposition substrate. On 2 September, the fermented straw infusion was prepared by mixing dry straw with water and left to ferment for three days. This approach is based on established research demonstrated that infusions containing fermented straw or grass enhance the attractiveness of *Aedes* species for oviposition (Reiter et al. 1991). A strip of light-colored paper was also attached to the inner wall of each container to serve as an egg-laying substrate (Sedaghat et al. 2025).

On 5 September, the prepared traps were deployed at the most suitable sites for vector presence, in accordance with the established guidelines. One trap was placed in a shelter pit where stagnant water and mosquito activity had previously been observed. All traps remained deployed for a continuous period of five days. During this period, the average ambient temperature was 39 °C, with a relative humidity of 51 %, which is consistent with the hot and semi-

arid late-summer climate of the study area (Paksa et al. 2024). on 10 September, all of the ovi-traps were collected and transferred to the field laboratory for analysis. Each trap was examined for larvae in the water and eggs on the paper strip. The strips containing were immersed in chlorinated water to artificially stimulate hatching of any unhatched eggs; this technique is commonly used in *Aedes* species monitoring (Sofizadeh et al. 2024). Upon inspection of the traps, a considerable number of live larvae were observed in the water from one trap (placed in the shelter pit), indicated that natural in situ hatching had occurred. The larvae, which were in early developmental stages, were transferred to a sterile containers containing chlorine-free water to allow maturation over three days,as the larval density precluded precise counting. Subsequently, approximately 50 larvae were randomly selected for laboratory analysis (Sofizadeh et al. 2024). The specimens were immediately preserved and cleared with lactophenol prior to being transferred to vials for further examination at the Department of Biology of Vectors and Control of Diseases, School of Public Health, Tehran University of Medical Sciences.

Following a minimum storage period of one a week, microscopic slides were prepared from the lactophenol-fixed samples in the laboratory (Sofizadeh et al. 2024). following preparation using appropriate cleaning media, the samples were examined phonologically under a light microscope. The morphological characteristics of the fourth-instar larvae were the primary focus. Standard morphological keys for the larvae of the family Culicidae were applied species identification. Taxonomical relevant features including the siphon index, the number and arrangement of pecten teeth, the morphology of the 10^{th} segment, and the configuration of dorsal scales on the eighth segment were considered during the identification of *Aedes*.

The identifications were verified by experienced entomologists and cross-referenced against illustrated taxonomic keys for valid arboviral disease vector species to ensure the accuracy of species identification (Paksa et al. 2024, 13). In accordance with WHO standards for monitoring invasive *Aedes* species, identification was based exclusively on morphological characteristics and molecular approaches were not employed in the present study.

Results

Of the six deployed ovitraps (Fig.2), Only one (16.7%) yielded positive results . This trap was positioned in the the shelter pit, which offered cooler and more protected conditions upon collection, it exhibited a notably high larval density; the water contained a dense population of larvae, indicating substantial oviposition activity at that site. Given the impracticality of accurate counting thee xcessive number of larvae, approximately 50 specimens were randomly selected for taxonomic identification. No egg or larvae were recovered from the other traps. Of the 50 specimens analyzed, three (6 %) were unambiguously identification as Ae. *aegypti* based on diagnostic larval morphology characteristics (Fig.3) (Azari-Hamidian and Harbach 2009). The remaining larvae belonged to other culicid species, most likely t representing local fauna elements . The identification of the three Ae. *aegypti* specimens was verified tby medical entomology experts. Although no adult mosquitoes were observed or collected during this survey, the successful hatching of Ae. *aegypti* eggs and the recovery of live larvae from the trap provide clear evidence of active reproduction of this species in Kazerun County.

During the five-day ovitrap exposure period, the daytime temperature averaged 39 °C,with a relative humidity of approximately 51 %, indicating that this species can locate suitable breeding sites even under Kazerun's semi-arid conditions. consequently, the presence of *Ae.aegypti* in Kazerun is now formally confirmed, underscoring the the critical importance of continuous surveillance and targeted control interventions in Fars Province. All specimens are deposited in the Entomology Museum at Tehran University of Medical Sciences.

Discussion

The presence of *Aedes aegypti* in Kazerun should be interpreted within the context of regional and global trends in the spread of this medically important vector. Dengue epidemics were first documented in the Eastern Mediterranean region of the WHO in 1998, and since then, the frequency and severity of outbreaks have in several countries within this region. recurrent dengue outbreaks have been reported in at least nine countries in the region (including Pakistan, Saudi Arabia, Yemen, and Sudan), with *Ae. aegypti* now recognized as the primary dengue vector across most of the region (WHO 2026).

For decades, Iran remained virtually free of *Aedes* vectors, despite its proximity to regional dengue hot spots. However, in recent years, *Ae.aegypti* has re-entered and become re-established in the country, in line with regional trend mentioned above. Dorzaban et al. (2022) confirmed the presence of this species in southern Iran (Hormozgan Province) for the first time after several decades of absence, identifying 55 specimens of *Ae.aegypti* and warning of the risk of dengue outbreaks and other *Aedes*-transmitted infections, given the widespread prevalence of arboviral diseases in neighboring countries and the continuous populations movement (Dorzaban et al. 2022).

Subsequent studies have indicated that geographic range of this mosquito has expanded throughout the country. The first detection of *Ae. aegypti* in southeastern Iran (Chabahar, Sistan and Baluchestan Province) occurred in late August 2023, and its local spread nearby counties was documented within one year. Approximately 17 months after its initial detection, this species was recorded in a larger city approximately 500 km to the north (Zahedan), suggesting a potential for rapid migration and spread (Sedaghat et al. 2025). Concurrently, reports of *Ae. aegypti* in additional southern provinces, including Bushehr and Khuzestan, have also emerged, with Fars Province now included for the first time (WHO 2026).

These results findings in Kazerun extend the known distribution range of this vector by approximately 400 kilometers to the northwest. The recovery of live larvae and successful breeding of *Ae. aegypti* in ovitraps in this semi-arid region suggest that this species is capable of surviving and reproducing even in warm and generally arid interior climates,relying on anthropogenic stagnant water sources near human dwelling , a condition previously documented in the desert climate Zahedan (Sedaghat et al. 2025). The establishment and spread of *Ae.aegypti* within Iranian territory have serious implications for public health. The establishment of this invasive vector has ultimately led to local transmission of the dengue virus within the country, as confirmed by the detection of the first autochthonous dengue cases with no history of travel in Bandar Lengeh (Hormozgan Province) in June 2024, with a cumulative total of 12 indigenous patients documented by mid-July (WHO 2026). Although the emergence of this small-scale outbreak may appear unexpected, it was predictable given the known presence of the vector in the country and the movement of individuals from endemic regions. This episode serves as a critical reminder for the public health system, underscoring the urgent need to strengthen preventive and control measures. Global experiences indicate that delayed implementation of timely interventions, coupled with insufficient investment in vector control activities, have contributed to the spread of *Aedes* mosquitos and enhanced disease transmission (https://phys.org/news/2024-06-reveals-huge-global-economic-invasive.html.). Conversely, the adoption of comprehensive preventive strategies including integrated vector management, active surveillance at entry points (e.g., airports and customs), public education campaigns, and community engagement has the potential to substantially reduce the health and economic burden of this threat (https://www.gdg.ca/en/article/study-on-the-economic-cost-of-mosquitoes).

Consequently, it is strongly recommended that active surveillance and targeted control initiatives for *Aedes* mosquitoes be promptly implemented in Fars Province and other vulnerable regions, supported by adequate resources and embedded within intersectoral and international collaborations, so that to prevent the full establishment and subsequent dissemination of *Ae. aegypti*, and thereby avert the emergence of widespread arboviral epidemics across the country.

Conclusion

The first detection of *Ae. aegypti* in Kazerun County extends the known distribution range of this invasive arbovirus vector in Iran. This finding underscores the urgent need for enhanced entomological surveillance and the implementation of vector control measures to mitiogate the risk of arboviral the transmission.

Acknowledgements

The authors gratefully acknowledge the Department of Vector Biology and Control of Diseases, School of Public Health, Tehran University of Medical Sciences, for its valuable support in the preparation of this manuscript. This work was carried out as part of a postgraduate students internship period conducted within the department.

Ethical Approval

Not applicable.

Authorship contributions

AZK, BG, JE, SR, and ZK contributed to conceptualization and writing—original draft. AZK, KA, BG, JE, SR, ZK and YR contributed to conceptualization and writing—review and editing. KA, JE, and YR reviewed and approved the final version of the manuscript.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Conflict of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Generative AI statement

The authors declare that no generative AI was used in the creation of this manuscript. During the preparation of this work, the authors used Grammarly AI to improve the readability and language. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

References

1. Roiz D, Pontifes PA, Jourdain F, Diagne C, Leroy B, Vaissière A-C, et al. The rising global economic costs of invasive *Aedes* mosquitoes and *Aedes* -borne diseases. Science of the Total Environment. 2024; 933:173054.

2. Castro MC, Wilson ME, Bloom DE. Disease and economic burdens of dengue. The Lancet Infectious Diseases. 2017;17(3): e70-e8.

3. Some 500 cases of dengue reported in six months: Tehran Times; [updated 2026/01/23. Available from: https://www.tehrantimes.com/news/518582/Some-500-cases-of-dengue-reported-in-six-months.

4. Dengue: World Health Organization, Regional Office for the Eastern Mediterranean; [updated 2026/01/23. Available from: https://www.emro.who.int/health-topics/dengue/.

5. Enayati A, Valadan R, Bagherzadeh M, Cheraghpour M, Nikookar SH, Fazeli-Dinan M, et al. Kdr genotyping and the first report of V410L and V1016I kdr mutations in voltage-gated sodium channel gene in *Aedes aegypti* (Diptera: Culicidae) from Iran. Parasites & vectors. 2024;17(1):34.

6. Dorzaban H, Soltani A, Alipour H, Hatami J, Jaberhashemi SA, Shahriari-Namadi M, et al. Mosquito surveillance and the first record of morphological and molecular-based identification of invasive species *Aedes* (Stegomyia) *aegypti* (Diptera: Culicidae), southern Iran. Experimental Parasitology. 2022;236-237:108235.

7. Disease Outbreak News: Dengue – Islamic Republic of Iran: World Health Organization; [updated 2026/01/23. Available from: https://www.who.int/emergencies/disease-outbreak-news/item/2024-DON526.

8. Calmard J. KAZERUN i. Geography. In: Encyclopaedia Iranica [Internet]. New York: Encyclopaedia Iranica Foundation; 2013 May 31 [cited 2026 Feb 21]. Available from: https://www.iranicaonline.org/articles/kazerun-i-geography/

9. Sedaghat MM, Enayati A, Nejati J. A Changing Scenario at a Regional Gateway: New Emergence of the Invasive Dengue Vector *Aedes aegypti*, in Zahedan, Southeastern Iran. Health Scope. 2025;15(1).

10. Reiter P, Amador MA, Colon N. Enhancement of the CDC ovitrap with hay infusions for daily monitoring of *Aedes aegypti* populations. Journal of the American Mosquito Control Association. 1991;7(1):52-5.

11. Paksa A, Azizi K, Yousefi S, Dabaghmanesh S, Shahabi S, Sanei-Dehkordi A. First report on the molecular phylogenetics and population genetics of *Aedes aegypti* in Iran. Parasites & vectors. 2024;17(1):49.

12. Sofizadeh A, Arzamani K, Bahlekeh Y, Soudmand M, Azari-Hamidian S. Bionomics of mosquito larvae (Diptera: Culicidae) in Golestan National Park, a biosphere reserve, northeastern Iran. Journal of Arthropod-Borne Diseases. 2024;18(4):311.

13. Azari-Hamidian S, Harbach RE. Keys to the adult females and fourth-instar larvae of the mosquitoes of Iran (Diptera: Culicidae). Zootaxa. 2009;2078(1):1-33.

14. Study reveals huge global economic costs of invasive species: Science X Network; [updated 2024/06 2026/01/23. Available from: https://phys.org/news/2024-06-reveals-huge-global-economic-invasive.html.

15. Study on the Economic Cost of Mosquitoes: Groupe de recherche en écologie végétale et animale (GDG); [updated 2026/01/23. Available from: https://www.gdg.ca/en/article/study-on-the-economic-cost-of-mosquitoes/.



Figure 1. location map of Kazerun County in Fars Province, Southwestern Iran.



Figure 2. Ovitrap system designed for entomological surveillance of *Aedes* spp. in Kazerun County, Iran.

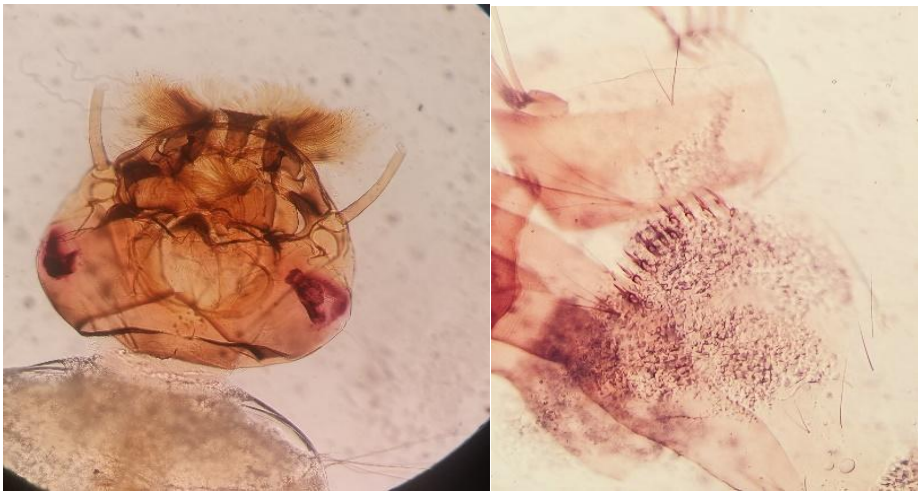


Figure 3. Main diagnostic morphological characteristics of fourth-instar *Ae. aegypti* larvae collected in Kazerun County, Iran (Left). The eighth abdominal segment bearing diagnostic comb scales (Right). The siphon, showing a single row of pecten teeth and a high siphon index, consistent with standards identification keys for Culicidae.