Archives of Razi Institute Journal

Volume 80, NO. 4, 2025

Journal homepage: https://archrazi.areeo.ac.ir

Mini Review

Oropouche Virus: The Silent Threat of a Re-emerging Arbovirus

Balamurugan Shanmugaraj[1,2]*, Karthikeyan Sankar[3]

1.Department of Biotechnology, Karpagam Academy of Higher Education, Coimbatore, 641021, Tamil Nadu, India.
2.Centre for Natural Products and Functional Foods, Karpagam Academy of Higher Education, Coimbatore, 641021, Tamil Nadu, India.
3.Department of Pharmaceutical Analysis, Faculty of Pharmacy, Karpagam Academy of Higher Education, Coimbatore, 641021, Tamil Nadu, India.

Article Info:

Received: 4 November 2024
Revised: 9 April 2025
Accepted: 11 April 2025

Keywords:

Arbovirus, emerging disease, Epidemiology, health threat,

ABSTRACT

Oropouche virus is a neglected, emerging virus that belongs to the *Peribunyaviridae* family and has caused significant public health concerns, especially in South America. Since its discovery in the 1950s, this virus has demonstrated a considerable impact on public health through its silent spread and occasional outbreaks. At least 30 major outbreaks have been reported, with more than half a million cases documented in many countries including Brazil, Peru, Panama, Trinidad and Tobago. In 2024, more than 16,000 confirmed cases were reported, including four deaths. It is endemic to Amazon and is currently spreading beyond its territory to non-endemic countries. It has been linked to human death for the first time, raising major concerns about the threat this virus poses to public health. The virus is primarily transmitted through the bite of the midge *Culicoides paraensis* and possibly by certain mosquito species. Oropouche virus fever does not exhibit specific clinical symptoms and is therefore often undiagnosed or misdiagnosed as other arboviral diseases. Currently, there are no vaccines or antiviral treatment available; hence, disease prevention mainly focuses on vector control and personal protection measures. Understanding the comprehensive drivers influencing the emergence and spread of this disease is vital for developing effective control and prevention strategies. This infection has recently emerged as one of the most important viral diseases in Latin America and is likely to remain a considerable threat to global public health in the near future. Here, an overview of Oropouche virus, it's clinical features, and pathogenesis are presented.

Corresponding Author:
balasbm17@gmail.com

How to cite this article: **Shanmugaraj B, Sankar K. Oropouche Virus: The Silent Threat of a Re-emerging Arbovirus. *Archives of Razi Institute*. 2025;80(4):813-818.** DOI: 10.66224/ARI.80.4.813

1. Context

Arboviral diseases are a group of infections that cause significant challenges to public health globally. Arboviral diseases are mainly transmitted by vectors such as mosquitoes, ticks, and midges (1, 2). These vectors have the ability to transmit the viruses to humans and animals resulting in life-threatening diseases such as dengue, zika, chikungunya, malaria and yellow fever (3, 4). Arboviruses are distributed worldwide, and arboviral infections range from mild to severe, occasionally resulting in death. Mosquitoes such as *Anopheles*, *Aedes*, and *Culex* are among the predominant vectors that transmit several arboviruses to humans (5). Hundreds of thousands of deaths were reported each year due to the arboviral diseases (6, 7).

A large number of human disease-causing arboviruses belong to the *Togaviridae, Flaviviridae, Bunyaviridae* and *Reoviridae* families. These viruses predominately circulate in tropical and subtropical regions, largely due to the high prevalence of vector populations (5). Hence, there is a significant burden, particularly in low- and middle-income countries in tropical regions. For instance, dengue was responsible for over 6.5 million cases and more than 7,300 fatalities worldwide in 2023 (8). A higher number of dengue cases were reported in over 80 countries. In Asia, the highest numbers were recorded in Bangladesh (321,000), Viet Nam (369,000), and Thailand (150,000) (9). Before 2015, Oropouche was the second most prevalent arboviral disease after dengue in South America. Today, many arboviral diseases are re-emerging in previously unreported regions due to the complex interplay of various factors such as urbanization, climate change, population growth, and increased global trade and travel (10, 11).

Arboviral infections such as Zika, Chikungunya and dengue have had a major impact on South America over the past decade (12). In addition, cases of Oropouche virus have been increasing in recent years. Oropouche virus is a reemerging arthropod-borne virus responsible for Oropouche fever, a disease characterized by severe acute febrile symptom. It is one of the neglected diseases, and its burden has often been overlooked due to significant underreporting. The virus was first identified in Trinidad and Tobago in 1955 (13) and until 2000, outbreaks were reported mainly in Brazil, Panama, and Peru. In 2023, the virus was reported in new areas of South America, highlighting its high potential to spread to non-endemic countries (14). This review presents an overview of the Oropouche virus, including its clinical features and pathogenesis.

2. Evidence Acquisition

2.1. Epidemiology

Oropouche virus is a spherical, enveloped virus (80 to 120 nm in diameter) belonging to the *Peribunyaviridae* family, order *bunyavirales*, and genus *Orthobunyavirus* (Simbu serogroup) (15). It is a negative-sense ribonucleic acid (RNA) virus consisting of three segments: small (S), medium (M), and large (L). The proteins encoded by these segments facilitates virus replication inside host cells and also help to evade the host immune response (16-18).

Oropouche fever was first reported in 1955, and subsequently, the virus was isolated from the blood of a symptomatic patient in a village of Vega de Oropouche, Trinidad (19). Since its identification, more than half a million human cases have been reported. The virus circulates throughout much of Central and South America, as well as the Caribbean (20). Oropouche virus fever is the most frequent arboviral disease after dengue fever (21). Although the virus was identified six decades ago, it has recently achieved increased attention due to its reemergence and outbreaks in different areas of South America during 2023-2024. its geographic range is expanding, where the virus is currently being reported in non-endemic areas (22, 23).

Since 2023, a significant increase in Oropouche fever cases has been reported in Brazil and surrounding countries, including Bolivia, Colombia, Cuba, Dominican Republic, Ecuador, Guyana and Peru. From 2015 to 2022, Brazil recorded only a small number of cases (261) of Oropouche fever. However, in 2023, there was a significant surge, with confirmed cases reaching 831. In 2024, approximately 16,239 confirmed cases were reported in the Americas region, including four deaths, whereas 3,765 confirmed Oropouche cases were reported in 2025 (as of Feb 11, 2025) (24-26). The virus was reported for the first time in Cuba, Ecuador and Guyana in 2024 (27). Travel-associated cases were reported in the USA, Canada, Italy, Germany and Spain, all involving travelers who had visited Brazil or Cuba (14, 28).

However, no local transmission has been reported in the USA. Two deaths associated with the Oropouche virus were confirmed by Brazilian Ministry of Health in the state of Bahia on July 25, 2024. Vertical transmission

resulting in congenital infection, fetal death, and microcephaly in pregnant women was reported in Brazil in August 2024 (29, 30). Brazil reported a case of encephalitis associated with this virus, 13 fetal deaths, three spontaneous miscarriages, and four cases of congenital anomalies (as of October 15, 2024) (31). These findings have raised serious concerns about the threat, this virus poses to public health.

2.2. Transmission

The virus exhibits both sylvatic and urban transmission cycles. In the sylvatic cycle, the vertebrate hosts include sloths (*Bradypus tridactylus*), non-human primates, and birds. In the urban cycle, humans are the primary hosts, and transmission occurs through the bite of infected midges- *Culicoides paraensis (*genus: *Culicoides*, Order: *Diptera*, Family: *Ceratopogonidae)* (32, 33). The genus *Culicoides* includes vectors of more than 50 arboviruses of human and veterinary importance (26).

The mosquitoes such as *Cx. quinquefasciatus*, *Cq. Venezuelensis*, and *Ae. serratus* can also act as possible vectors and transmit the disease primarily in sylvatic environment (34, 35). There is no evidence of human-to-human transmission reported so far. During the first week of illness, the virus has been detected in serum samples, but it is not detected beyond day 5 (36). Viral RNA can be detected using real-time reverse transcription-polymerase chain reaction (RT-PCR), while virus-specific neutralizing antibodies can be detected through plaque reduction neutralization tests (PRNTs). Currently, diagnostic or rapid tests based on antigens or immunoassays are not commercially available (37, 38).

2.3. Symptoms and Treatment

Most symptoms are usually mild and self-limiting, appearing four to eight days after an infected bite and lasting up to seven days. The incubation period is variable, typically ranging from three to ten days (39). Symptoms resemble those of other mosquito-borne infections such as dengue, chikungunya, and zika, making clinical differentiation challenging (40, 41). In some cases, Oropouche virus fever goes undiagnosed due to mild symptoms or is misdiagnosed because of its similar clinical characteristics to other arboviral diseases (42). It presents with a sudden onset of fever (38-40°C), chills, headache, extreme weakness, joint pain, muscle aches, nausea, and vomiting (43, 44). Other symptoms include diarrhea, bleeding, abdominal pain, retro-orbital pain, photophobia, dizziness, conjunctival injection.

The infection typically resolves within two to three weeks; however, in some cases, severe complications such as meningitis or encephalitis have been reported (45). Some affected individuals reported recurrent symptoms following the resolution of their initial illness (46). Although fatal outcomes are rare, mortality has been reported in Brazil (26).

Treatment is primarily supportive, consisting of rest, hydration, and the use of analgesics and antipyretics to alleviate the symptoms. Hospitalization might be necessary if the patient presents with severe symptoms or complications. Vaccine development efforts are currently underway to control Oropouche virus infection, including chemically inactivated, DNA-vectored, live attenuated, and protein-subunit approaches (38, 39, 44).

3. Results

Arboviral diseases are challenging to manage due to their complex transmission dynamics, unpredictable outbreaks, and limited treatment options. Research on vector competence studies, transmission and viral pathogenesis is essential. Due to the unpredictable nature of viral diseases, it is essential for all countries to be prepared for the unexpected. The local and national health authorities should focus on preventing small, localized viral outbreaks from escalating into epidemics or pandemics by implementing integrated surveillance systems, emergency response protocols, and community-based prevention strategies (47). As Oropouche virus spreads into new territories, epidemiological and entomological surveillance are critical to reinforcing the prevention measures. Early detection and differential diagnosis are essential for effective patient management and to help prevent potential virus transmission.

Currently, there are no licensed vaccines or specific antiviral therapies available to treat Oropouche virus disease. Plant-based expessionsystems can be utilized to produce immunogenic proteins of the Oropouche virus for vaccine development (45). The genetic diversity of the virus makes vaccine development a challenging task. Therefore, vector control and personal protection strategies appear to be the most effective prevention and control measures at present. Monitoring vectors is crucial, as they play an important role in disease transmission.

The risk of infection can be reduced by lowering midge populations through the control of breeding sites around at-risk communities, and by minimizing vector bites using mosquito nets, insect repellants, and insecticides (47).

Further educating at-risk communities in endemic regions about the potential health threats posed by midge bites, along with personal protection options, can also significantly help prevent Oropouche virus transmission.

4. Conclusion

Oropouche virus is a neglected arbovirus that has recently emerged as a major public health threat, causing significant outbreaks in South America. Like other arboviral diseases, Oropouche virus fever has been considered as a neglected disease for the past six decades. Now, the Oropouche virus is reemerging and has become one of the most significant viral diseases in Latin America, likely to remain a considerable threat to global public health in the future. Hence, further research is essential to assess the disease burden, and there is an urgent need to develop effective vaccines to respond effectively to future outbreaks.

Acknowledgment

The authors are thankful to Karpagam Academy of Higher Education and DST-FIST (SR/FST/LS-I/2018/187 dt 20.12.2018) for the support.

Authors' Contribution

Study concept and design: B.S
Acquisition of data: B.S
Drafting of the manuscript: B.S., K.S
Critical revision of the manuscript: B.S., K.S

Ethics

Not applicable.

Conflict of Interest

The authors declare no conflict of interests.

Funding

This research received no external funding. This study received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Data Availability

The data sharing is not applicable to this article as no new datasets were generated or analyzed during the current study.

References

1. Wilder-Smith A, Gubler DJ, Weaver SC, Monath TP, Heymann DL, Scott TW. Epidemic arboviral diseases: priorities for research and public health. The Lancet infectious diseases. 2017;17(3):e101-e6
2. Kampen H, Werner D. Biting midges (Diptera: Ceratopogonidae) as vectors of viruses. Microorganisms. 2023;11(11):2706
3. Paixão ES, Teixeira MG, Rodrigues LC. Zika, chikungunya and dengue: the causes and threats of new and re-emerging arboviral diseases. BMJ global health. 2018;3(Suppl 1)
4. Murugan SB, Sathishkumar R. Chikungunya infection: A potential re-emerging global threat. Asian Pacific journal of tropical medicine. 2016;9(10):933-7
5. Liang G, Gao X, Gould EA. Factors responsible for the emergence of arboviruses; strategies, challenges and limitations for their control. Emerging microbes & infections. 2015;4(1):1-5
6. Tajudeen YA, Oladunjoye IO, Mustapha MO, Mustapha ST, Ajide-Bamigboye NT. Tackling the global health threat of arboviruses: An appraisal of the three holistic approaches to health. Health promotion perspectives. 2021;11(4):371
7. Manouana GP, Sarah-Matio E-M, Hellhammer F, Zahouli JZB, Tapé ASB, Biré YN, et al. Ecology of arboviruses and their potential mosquito vectors in Benin, Côte d'Ivoire and Gabon: a mini review. Frontiers in Tropical Diseases. 2024;5:1355778
8. Haider N, Hasan MN, Onyango J, Asaduzzaman M. Global landmark: 2023 marks the worst year for dengue cases with millions infected and thousands of deaths reported. IJID regions. 2024;13:100459
9. Yousuf R, Salam MW, Akter S, Sinha S, Haque M. Dengue dynamics: a global update. Advances in Human Biology. 2024;14(1):5-10
10. Shanmugaraj B. Mpox global health crisis: Implications and actions. Asian Pacific Journal of Tropical Medicine. 2025;18(1):1-2

11. Shanmugaraj B. A call for proactive public health preparedness against the Zika virus in India. Microbes and Infectious Diseases. 2024; 6(3): 979-983
12. Santos LL, de Aquino EC, Fernandes SM, Ternes YMF, Feres VCdR. Dengue, chikungunya, and Zika virus infections in Latin America and the Caribbean: a systematic review. Revista panamericana de salud publica. 2023;47:e34
13. Anderson CR, Spence L, Downs WG, Aitken TH. Oropouche virus: a new human disease agent from Trinidad, West Indies. 1961
14. Morrison A. Oropouche virus disease among US travelers—United States, 2024. MMWR Morbidity and Mortality Weekly Report. 2024;73
15. Hughes HR, Adkins S, Alkhovskiy S, Beer M, Blair C, Calisher CH, et al. ICTV virus taxonomy profile: Peribunyaviridae. Journal of General Virology. 2020;101(1):1-2
16. Elliott RM. Orthobunyaviruses: recent genetic and structural insights. Nature Reviews Microbiology. 2014;12(10):673-85
17. Files MA, Hansen CA, Herrera VC, Schindewolf C, Barrett AD, Beasley DW, et al. Baseline mapping of Oropouche virology, epidemiology, therapeutics, and vaccine research and development. npj Vaccines. 2022;7(1):38
18. Ladner JT, Savji N, Lofts L, Travassos da Rosa A, Wiley MR, Gestole MC, et al. Genomic and phylogenetic characterization of viruses included in the Manzanilla and Oropouche species complexes of the genus Orthobunyavirus, family Bunyaviridae. Journal of General Virology. 2014;95(5):1055-66
19. Gutierrez B, Wise EL, Pullan ST, Logue CH, Bowden TA, Escalera-Zamudio M, et al. Evolutionary dynamics of Oropouche virus in South America. Journal of virology. 2020;94(5):10.1128/jvi. 01127-19
20. Sakkas H, Bozidis P, Franks A, Papadopoulou C. Oropouche fever: a review. Viruses. 2018;10(4):175
21. Riccò M, Corrado S, Bottazzoli M, Marchesi F, Gili R, Bianchi FP, et al. (Re-) Emergence of Oropouche Virus (OROV) Infections: Systematic Review and Meta-Analysis of Observational Studies. Viruses. 2024;16(9):1498
22. Bandeira AC, Pereira FM, Leal A, Santos SP, Barbosa AC, Souza MSPL, et al. Fatal Oropouche virus infections in nonendemic region, Brazil, 2024. Emerging Infectious Diseases. 2024;30(11):2370
23. Diseases TLI. Oropouche fever, the mysterious threat. 2024. p. S1473-3099 (24) 00516-4.
24. Martins-Filho PR, Carvalho TA, Dos Santos CA. Oropouche fever: reports of vertical transmission and deaths in Brazil. The Lancet Infectious Diseases. 2024;24(11):e662-e3
25. Scachetti GC, Forato J, Claro IM, Hua X, Salgado BB, Vieira A, et al. Re-emergence of Oropouche virus between 2023 and 2024 in Brazil: an observational epidemiological study. The Lancet Infectious Diseases. 2025;25(2):166-75
26. Guagliardo SAJ, Connelly CR, Lyons S, Martin SW, Sutter R, Hughes HR, et al. Reemergence of Oropouche virus in the Americas and risk for spread in the United States and its territories, 2024. Emerging infectious diseases. 2024;30(11):2241
27. Tilston-Lunel NL. Oropouche virus: An emerging orthobunyavirus. Journal of General Virology. 2024;105(10):002027
28. Portillo MT, Marwah A, Kraemer MU, Thomas-Bachli A, Khan K, Bogoch II. Potential for international spread of Oropouche virus via commercial air travel. Journal of travel medicine. 2024;31(8):taae128
29. Schwartz DA, Dashraath P, Baud D. Oropouche virus (OROV) in pregnancy: an emerging cause of placental and fetal infection associated with stillbirth and microcephaly following vertical transmission. Viruses. 2024;16(9):1435
30. Lenharo M. Mysterious Oropouche virus is spreading: what you should know. Nature. 2024
31. Sick F, Beer M, Kampen H, Wernike K. Culicoides biting midges—underestimated vectors for arboviruses of public health and veterinary importance. Viruses. 2019;11(4):376
32. Pinheiro FP, Travassos da Rosa AP, Travassos da Rosa JF, Ishak R, Freitas RB, Gomes ML, et al. Oropouche virus I. A review of clinical, epidemiological, and ecological findings. 1981
33. Mellor P, Boorman J, Baylis M. Culicoides biting midges: their role as arbovirus vectors. Annual review of entomology. 2000;45(1):307-40
34. de Mendonça SF, Rocha MN, Ferreira FV, Leite THF, Amadou SC, Sucupira PH, et al. Evaluation of Aedes aegypti, Aedes albopictus, and

Culex quinquefasciatus mosquitoes competence to Oropouche virus infection. Viruses. 2021;13(5):755
35. Labiod N, Chamorro-Tojeiro S, de la Calle-Prieto F, Gutiérrez-López R, Sánchez-Seco MP, Vázquez A. Oropouche Virus, A New Emerging Threat. Current Infectious Disease Reports. 2025;27(1):13
36. Da Rosa JFT, De Souza WM, de Paula Pinheiro F, Figueiredo ML, Cardoso JF, Acrani GO, et al. Oropouche virus: clinical, epidemiological, and molecular aspects of a neglected orthobunyavirus. The American journal of tropical medicine and hygiene. 2017;96(5):1019
37. Eckerle I, Briciu V, Ergönül Ö, Lupşe M, Papa A, Radulescu A, et al. Emerging souvenirs—clinical presentation of the returning traveller with imported arbovirus infections in Europe. Clinical Microbiology and Infection. 2018;24(3):240-5
38. Durango-Chavez HV, Toro-Huamanchumo CJ, Silva-Caso W, Martins-Luna J, Aguilar-Luis MA, del Valle-Mendoza J, et al. Oropouche virus infection in patients with acute febrile syndrome: is a predictive model based solely on signs and symptoms useful? PLoS One. 2022;17(7):e0270294
39. Mourão MPG, Bastos MS, Gimaque JBL, Mota BR, Souza GS, Grimmer GHN, et al. Oropouche fever outbreak, Manaus, Brazil, 2007–2008. Emerging infectious diseases. 2009;15(12):2063
40. Sah R, Srivastava S, Mehta R, Khan SR, Kumar S, Satpathy P, et al. Oropouche fever fatalities and vertical transmission in South America: implications of a potential new mode of transmission. The Lancet Regional Health–Americas. 2024;38
41. Wesselmann KM, Postigo-Hidalgo I, Pezzi L, de Oliveira-Filho EF, Fischer C, de Lamballerie X, et al. Emergence of Oropouche fever in Latin America: a narrative review. The Lancet Infectious Diseases. 2024;24(7):e439-e52
42. Porwal S, Malviya R, Sridhar SB, Shareef J, Wadhwa T. Mysterious Oropouche virus: transmission, symptoms, and control. Infectious Medicine. 2025:100177
43. Conway MJ, Colpitts TM, Fikrig E. Role of the vector in arbovirus transmission. Annual review of virology. 2014;1(1):71-88
44. Shanmugaraj B, Loganathan N, Chandra HM. Plant system as a versatile and robust platform for the development of vaccines against arboviral infections. Vacunas (English Edition). 2024;25(4):492-501
45. Zhang Y, Liu X, Wu Z, Feng S, Lu K, Zhu W, et al. Oropouche virus: A neglected global arboviral threat. Virus research. 2024;341:199318
46. Morrison A, White JL, Hughes HR, Guagliardo SAJ, Velez JO, Fitzpatrick KA, et al. Oropouche Virus Disease Among U.S. Travelers - United States, 2024. MMWR Morbidity and mortality weekly report. 2024;73(35):769-73.https://doi.org/10.15585/mmwr.mm7335e1.
47. Douglas KO. The silent invaders: Oropouche and Melao viruses, causes of increased public health risks for the Americas. Infectious Diseases. 2024;56(11):1009-14