



Rethinking Dengue Control: A Biological Pathway to Protecting Hard-to-Reach Populations

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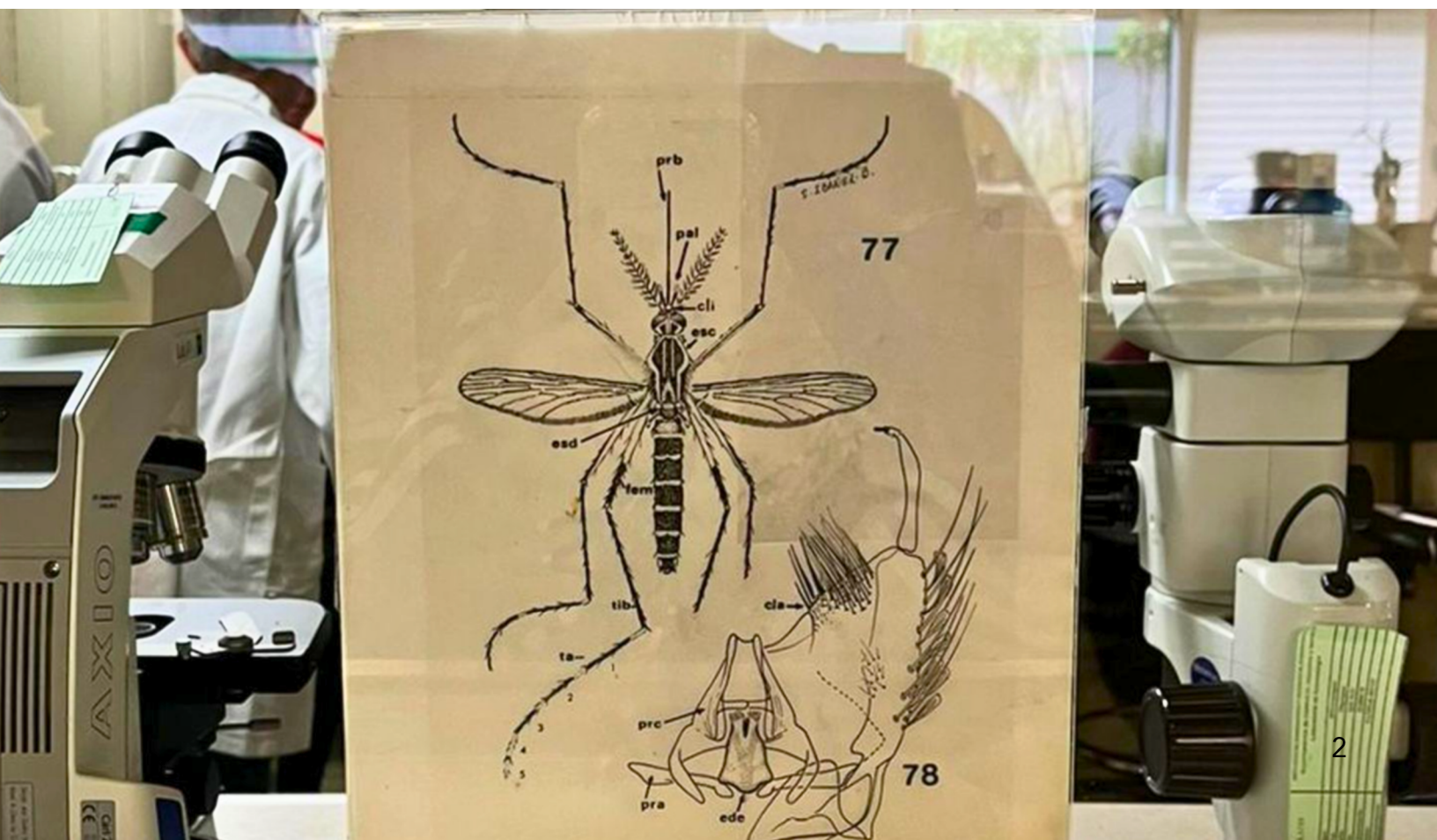
Executive Summary

Dengue has become an escalating threat for marginalized peri-urban communities, where poor water and sanitation conditions create environments that favor the spread of *Aedes aegypti*.

Traditional pesticide-based strategies have shown limited impact and caused environmental harm, underscoring the urgent need for sustainable alternatives. Within this context, our study explores the potential of *Rosenbergiella nectarea* as a biological agent that could contribute to new control strategies.

To advance this approach, we conducted fruit sampling across different regions of Mexico and developed a DNA extraction protocol aimed at detecting the bacterium through PCR techniques. While the results did not confirm its presence, this outcome is not a failure but rather a significant finding: the absence of *Rosenbergiella* in Mexican flora opens the opportunity to evaluate its controlled introduction in strategic areas, exploring its potential as an innovative tool in vector management.

This approach represents not only a scientific innovation but also a viable alternative for health systems seeking to reduce reliance on chemical pesticides. By offering a less harmful and potentially more equitable strategy, the proposal aligns with national and international efforts to contain dengue and provides a promising pathway to protect hard-to-reach populations worldwide.



Mapping of Policy Stakeholders

The feasibility of a microbial solution for dengue control relies on a network of stakeholders that extends beyond scientific and regulatory institutions.

In addition to public health authorities such as Mexico's Ministry of Health and InDRE, and international organizations like PAHO and WHO, it is crucial to involve stakeholders dedicated to public communication and awareness.

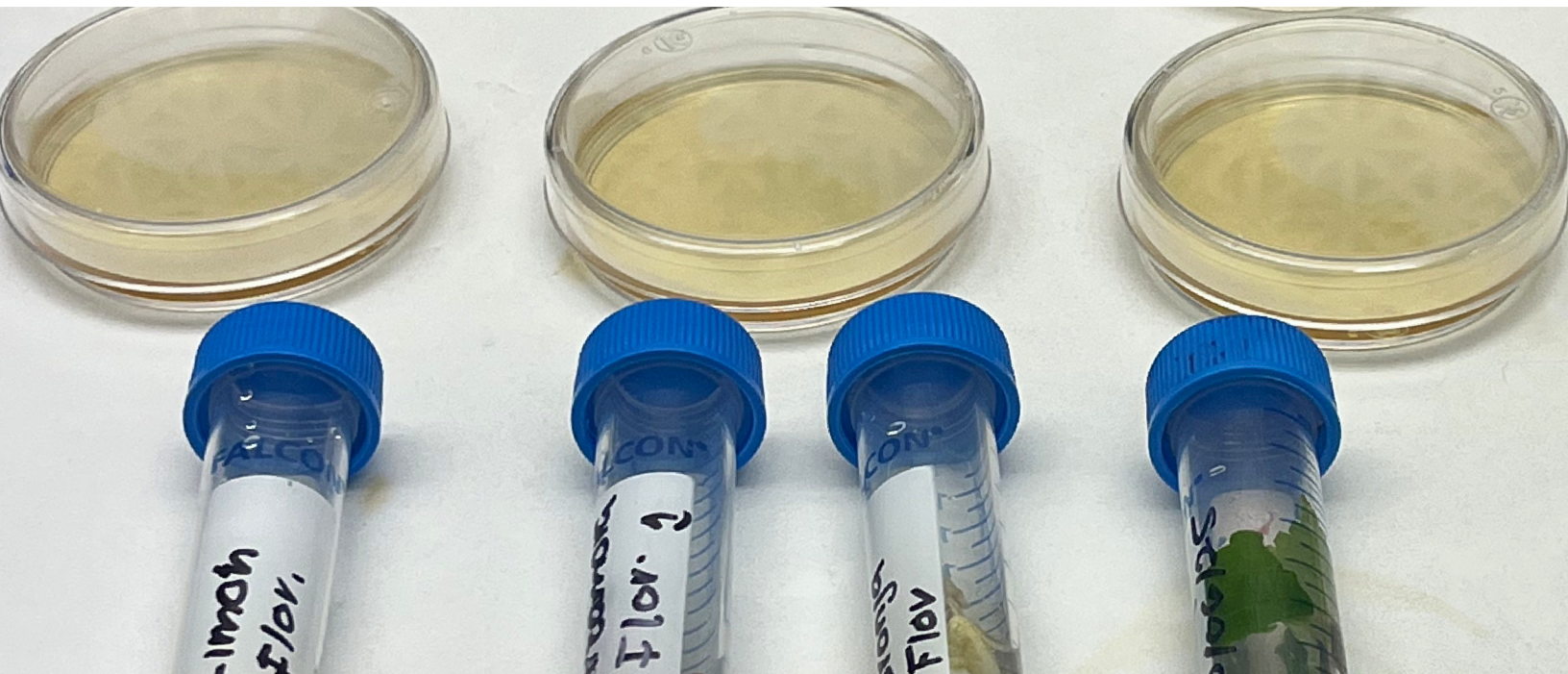
Media outlets, community organizations, and scientific outreach networks can play a decisive role in informing the population and fostering social approval for the potential introduction of bacteria into ecosystems.

The most direct beneficiaries would be vulnerable peri-urban communities, where poor sanitation conditions heighten exposure to the mosquito vector.

Yet the proposal may also face resistance: pesticide industries could perceive economic threats, and some community groups may express skepticism toward the introduction of microorganisms into their environment.

Building trust through transparent communication and community participation will therefore be essential.





Solutions

The findings of our study highlight the need to move toward innovative alternatives to chemical-based dengue control. The validation of a DNA extraction protocol in fruits, designed to detect *Rosenbergiella nectarea* through PCR, represents a methodological advance that enables reliable ecological surveillance and lays the groundwork for future research.

Although the bacterium was not detected yet in samples collected across different regions of Mexico, this outcome opens new lines of work that can strengthen the development of more sustainable biological solutions.

The proposal unfolds in progressive stages that ensure safety and scientific rigor. First, efforts to find the bacteria in Mexican environments will continue, however also focusing on obtaining the bacterium from another country where it is available, in order to establish a positive control that validates detection techniques and later continue the search within Mexican ecosystems.

Once this step is secured, the next phase involves laboratory functional studies to understand the bacterium's interaction with mosquitoes. This will be followed by ecological impact assessments to safeguard ecosystems. Before moving into pilot trials, a community awareness phase will be introduced in the areas where the bacterium is planned to be released, ensuring that local populations understand the process and recognize its null risk to human health. Finally, pilot trials will be conducted under regulatory oversight and with community participation.

This pathway acknowledges existing gaps, such as limited ecological data and the need for field-ready dissemination mechanisms, while leveraging the opportunity to move toward a more sustainable model of dengue control, less reliant on chemical pesticides.

Recommendations

Deep Dive

For this proposal to advance in a robust way, it is necessary to chart a pathway that combines scientific rigor with political and social feasibility.

Regarding context and political fit, the initiative aligns with Mexico's national efforts to reduce reliance on pesticides and with global strategies led by PAHO and WHO that promote more sustainable dengue control.

This framework provides institutional legitimacy but requires a careful regulatory approval process, including biosafety evaluations and the involvement of both health and environmental authorities.

In terms of institutional and operational feasibility, the development of this solution demands strengthened capacities in molecular biology, as well as infrastructure for controlled laboratory and semi-field trials.

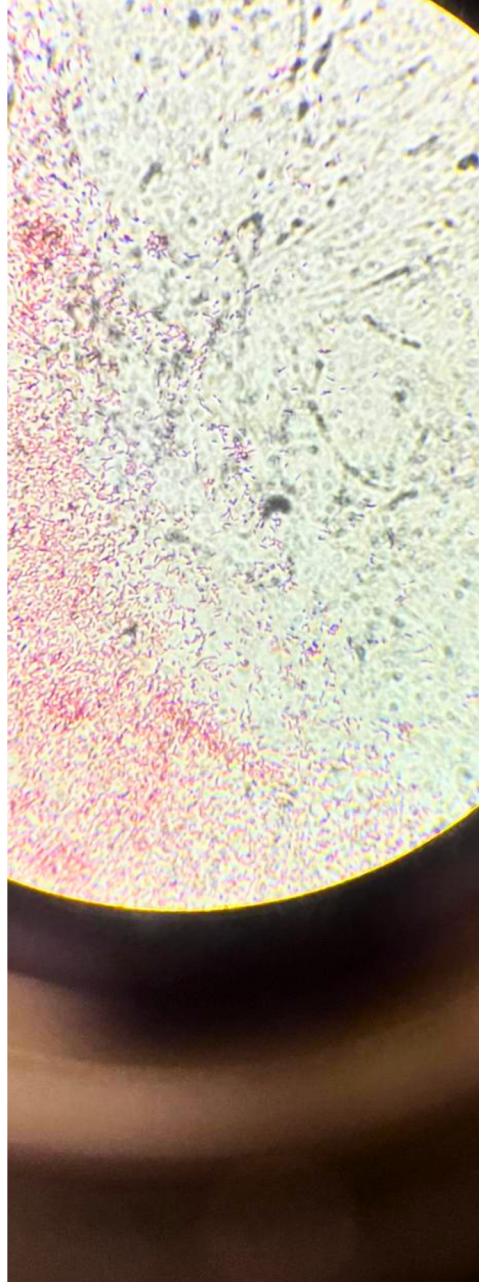
Establishing standardized monitoring protocols and fostering collaboration with universities and research centres will be essential to ensure quality and reproducibility of results.

Financial considerations are equally critical: funding will be needed to support laboratory experimentation, field validation, and community communication programs.

Potential sources include international organizations such as PAHO and WHO, national research funds like CONACYT, universities, and partnerships with the private biotechnology sector.

Finally, the stakeholder and social dimensions represent both opportunities and challenges. Vulnerable communities would be the main beneficiaries, but their active participation is indispensable to build trust and acceptance.

A community awareness phase will help clearly explain the objectives and the null risks to human health, while transparent communication will be key to counteracting potential resistance from pesticide industries or skeptical groups.



Prioritization and Technical Assistance for Implementation

For this proposal to move forward in a safe and structured way, it is essential to establish clear priorities and define the technical assistance required at each stage. The first step is to secure a positive control of *Rosenbergiella nectarea* from another country, enabling the validation of detection techniques and strengthening the scientific foundation of the project. Once achieved, the immediate priority will be to obtain biosafety and ethical approvals to support the initial laboratory studies.

Subsequently, functional studies and ecological impact assessments must be consolidated, ensuring that any potential introduction of the bacterium occurs under strictly controlled conditions. Before advancing to pilot trials, a community awareness phase will be critical: informing local populations about the process, its objectives, and the absence of health risks, thereby fostering trust and active participation.

In terms of technical assistance, specialized support will be needed in molecular biology to refine detection protocols, in microbial ecology and entomology to evaluate interactions with the vector and ecosystem, and in risk analysis to design robust regulatory frameworks. Equally important will be the involvement of community communication experts to facilitate transparent dialogue with local populations. Organized progressively, these actions will allow the proposal to evolve from a scientific concept into an ethical, safe, and socially accepted implementation.

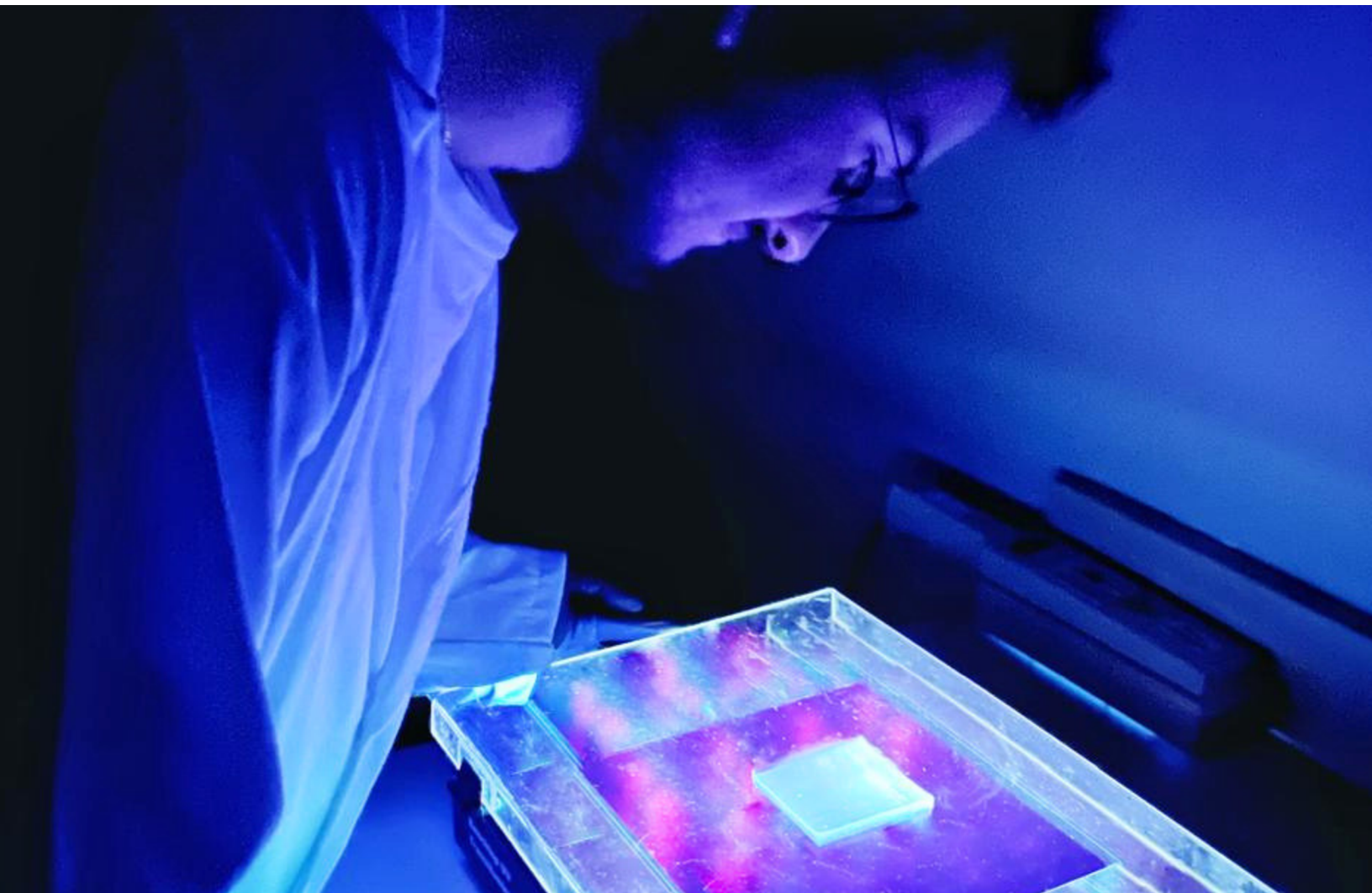


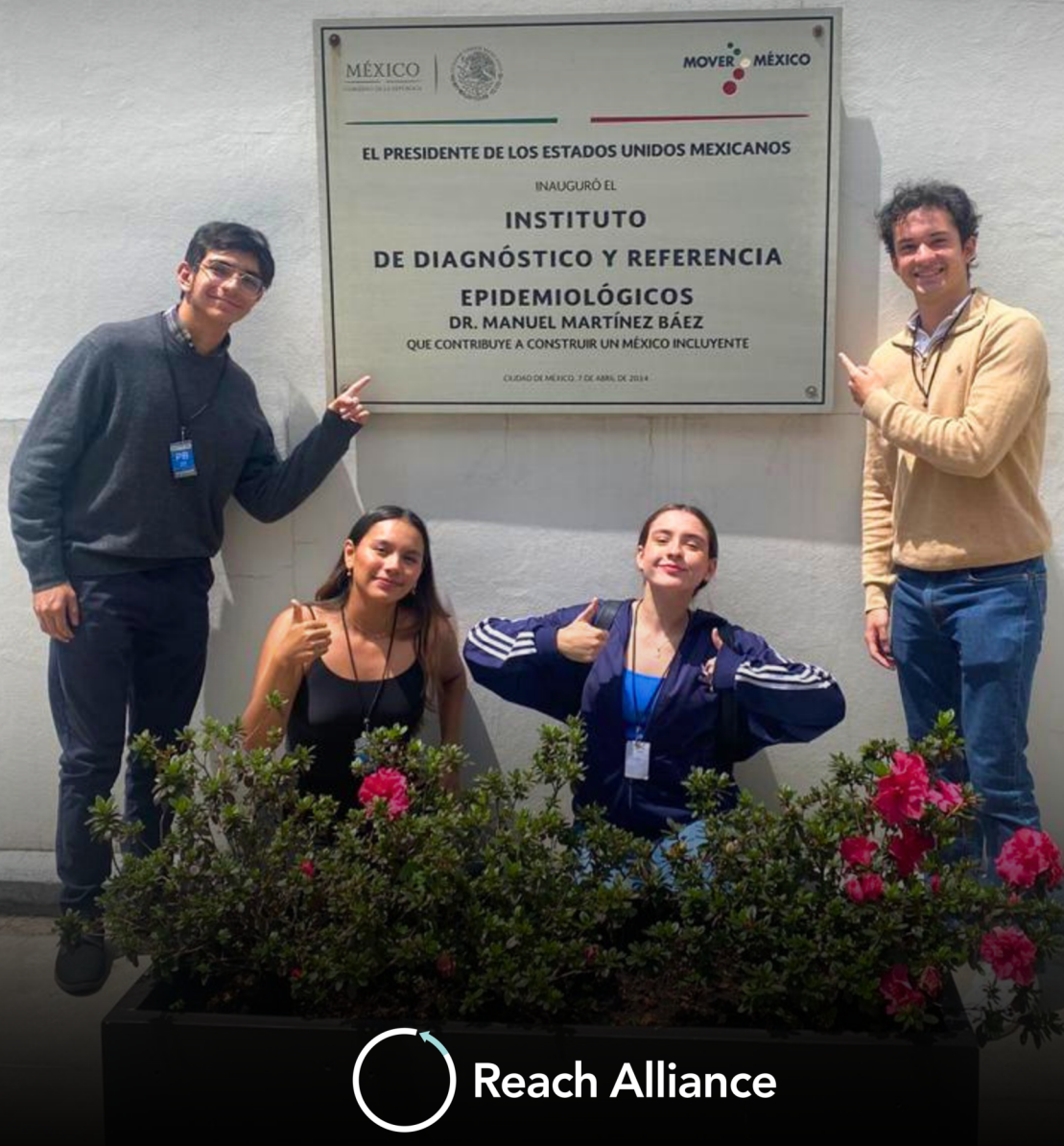
Conclusion

Once again, we are reminded that many solutions to human challenges can be found in nature itself. Nature contains remarkable mechanisms that, when studied and applied responsibly, may help us address complex problems in sustainable ways.

This project demonstrates the value of exploring biological alternatives to conventional dengue control and highlights the potential of *Rosenbergiella nectarea* as part of a more sustainable public health strategy. Our findings provide an important foundation for future research and help define a pathway for evaluating nature-based interventions in real-world settings. While further scientific validation is required, the opportunity of using *Rosenbergiella nectarea* to develop innovative, environmentally responsible approaches to dengue prevention remains significant.

As dengue continues to disproportionately affect vulnerable and hard-to-reach populations, greater emphasis must be placed on prevention rather than reaction. By investing in innovation, community engagement, and evidence-based implementation, nature-inspired solutions could become an important tool for reducing disease burden and strengthening public health resilience.





This work builds on the 2024-25 Reach research report, "[Searching for a Solution to Contain the Increasingly Dangerous Dengue Fever](#)," by Pamela Guzmán-Coronel, Danna Paulina Navarro-Mora, Aitor Emilio Rodríguez-Reyes, Emilio Romero-González, Jorge Membrillo-Hernández, and all the impactful partners, community members, and mentors involved in the research.

As part of the "Pathways from Evidence to Action" series, inspired by the African Center for Equitable Development (ACED), the Reach Alliance challenged researchers to identify connections, address gaps, and develop recommendations grounded in their findings. The series comprises thirteen briefing notes developing solutions for urgent climate, public health, and economic challenges and engages practitioners and policymakers in advancing pathways to implementation.

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