



Editorial

The innovation of Wolbachia mosquito technology to control dengue hemorrhagic fever

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ABSTRACT

Wolbachia is a bacterium that generally occurs naturally in 50% of insect species, lives in insect cells, and is passed from one generation to the next through insect eggs. Wolbachia in the mosquito's body can inhibit the replication of the Dengue virus or other viruses. Based on the Decree of the Minister of Health of the Republic of Indonesia Number 1341 concerning the Implementation of the Pilot Project for the Implementation of Wolbachia as a Dengue Management Innovation, the application of this technology was carried out in five cities, namely Semarang City, West Jakarta, Bandung City, Kupang City, and Bontang City. The effectiveness of Wolbachia itself has been proven and researched since 2011, when it was conducted in Yogyakarta. As a result, Wolbachia was proven to reduce dengue fever cases by up to 77% and reduce the proportion of hospital admissions by 86%. This method of spreading Wolbachia mosquitoes in several cities will reduce local transmission of infection in those areas. This reduction in local transmission of dengue infection occurs both in the rainy and dry seasons. Scientifically, the success of the Wolbachia method is apparent, but the controversy is due to confused information circulating, giving rise to concern among the public. Vector control using Wolbachia is an alternative disease control method that uses mosquito vectors and is quite effective. However, the application of Wolbachia in the community must be monitored continuously to determine its impact on humans, local mosquitoes, and the ecosystem.

INTRODUCTION

In several regions in Indonesia, there is widespread information about the pros and cons of using innovative Wolbachia mosquito technology. What is the Wolbachia mosquito? How is it breeding? Wolbachia is a bacterium that generally occurs naturally in 50% of insect species, lives in insect cells, and is passed from one generation to the next through insect eggs. The *Aedes aegypti* mosquito does not usually carry Wolbachia, but many other mosquitoes carry this bacterium. Wolbachia is safe for humans and the environment.^{1,2}

When the *Aedes aegypti* mosquito carries Wolbachia, the bacterium complete with viruses such as the Dengue Hemorrhagic Fever (DHF) virus, Zika virus, Chikungunya virus, and yellow fever virus. Wolbachia in the mosquito's body can inhibit the replication of the Dengue virus or other viruses. The *Aedes aegypti* mosquito is the primary vector of the Dengue virus. The *Aedes aegypti* mosquito, which carries the Wolbachia bacterium, cannot transmit the Dengue virus between humans through its bite.³

Based on the Decree of the Minister of Health of the Republic of Indonesia Number 1341 concerning the Implementation of the Wolbachia Implementation Pilot Project

as a Dengue Management Innovation, the application of this technology was carried out in five cities, namely Semarang City, West Jakarta, Bandung City, Kupang City, and Bontang City. The effectiveness of Wolbachia itself has been studied since 2011, when it was carried out in Yogyakarta. As a result, Wolbachia was proven to reduce fever cases by up to 77% and reduce the proportion of hospital admissions by 86%.⁴

Wolbachia bacterium change the way the mosquito's reproductive system works. This bacterium makes female mosquitoes more likely to mate with male mosquitoes infected with Wolbachia and causes the population of *Aedes aegypti* mosquitoes infected with Wolbachia to increase naturally. It is hoped that Wolbachia-infected mosquitoes can become a new hope for the Indonesian people in controlling the spread of dengue fever.⁵

This method of spreading Wolbachia mosquitoes in several cities will reduce local transmission of infection in those areas. This reduction in local transmission of dengue infection occurs both in the rainy and dry seasons. The release of Wolbachia-infected mosquitoes is a one-time application (one shot), lasts long term, and can be integrated with existing control programs, namely Mosquito Nest Eradication, draining, burying and covering, the release of

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larvae-eating fish, sowing of Abate, and another engineering.⁶

CAN THE COMMUNITY ACCEPT WOLBACHIA MOSQUITO TECHNOLOGY?

Wolbachia mosquito technology can be applied in all endemic areas in Indonesia, but people must understand how the process works. A hoax about Wolbachia mosquitoes says transgenic technology must disappear so society is ready for it. Scientifically, the success of the Wolbachia method is apparent, but the controversy is due to confused information circulating, thus causing concern among the public. The controversy that emerged included: Wolbachia mosquitoes are genetically engineered, contain LGBT genes, a depopulation program or a program to track someone by implanting a microchip, and other disinformation is inaccurate information. The task of academics is to educate the public on this erroneous understanding.^{1,2,7}

The application of Wolbachia technology has become part of the national strategy for controlling dengue fever in Indonesia, which aims to reduce the spread of the *Aedes aegypti* mosquito, which carries the dengue virus. Collaboration between government, health institutions, researchers, and communities is crucial for the success of Wolbachia technology in controlling dengue fever.⁸ Several issues related to the spread of Wolbachia in society include rejection in various areas such as Bali and Bandung. This rejection was due to a lack of socialization. Many people are afraid and worried because they do not know the risks and benefits of Wolbachia technology. Release of Wolbachia into the field can also cause complicated clinical symptoms due to difficulties in diagnosing disease symptoms and cause poor health in humans.⁹

FACTS ON WOLBACHIA MOSQUITOES

Some facts about Wolbachia mosquitoes: 1) Wolbachia mosquitoes are obtained naturally without any genetic engineering. Wolbachia is an environmentally friendly natural insect bacterium because it does not disturb the ecosystem or the life cycle of other microorganisms; 2) The Wolbachia mosquito is said to make the *Aedes aegypti* mosquito sterile and not transmit dengue fever. Therefore, the number of people infected with dengue fever will significantly reduce; 3) Wolbachia mosquitoes have been proven to reduce the spread of dengue fever in nine countries, namely Brazil, Australia, Vietnam, Fiji, Vanuatu, Mexico, Kiribati, New Caledonia, and Sri Lanka; 4) Wolbachia is claimed to be able to paralyze the Dengue virus in the body of the *Aedes aegypti* mosquito, preventing its transmission to the human body; 5) The effectiveness of Wolbachia has been researched since 2011-2015

through the preparation and release phase of *Aedes aegypti* containing Wolbachia on a limited scale; 6) One of the cities that is a pilot project for the spread of Wolbachia mosquitoes to suppress dengue fever is Semarang City, launching the "Wolbachia Ing Kota (Wingko) Semarang" program at the end of May 2023 in Tembalang District, which is an endemic area for dengue fever; 7) The itching effect caused by a Wolbachia mosquito bite is still the same as that of the *Aedes aegypti* mosquito, but it no longer transmits the Dengue virus.¹⁰⁻¹⁵

CONCLUSION AND RECOMMENDATION

There are many ways to control DHF including biological vector control using Wolbachia bacterium. Wolbachia bacterium can survive in the *Aedes aegypti* mosquito's body, inhibiting reproduction to stop the replication of the Dengue virus in the mosquito's body. The application of Wolbachia technology has become part of Indonesia's national strategy to control dengue fever. This strategy aims to reduce the spread of the *Aedes aegypti* mosquito, which carries the Dengue virus. It has been implemented in five cities in Indonesia, one of which is Semarang City.

The application of Wolbachia in mosquito control raises pros and cons in various circles, such as whether Wolbachia can infect the human body, whether cross-breed mosquitoes are harmless, and many others. Vector control using Wolbachia is an alternative to disease control using mosquito vectors, and it is compelling. However, the application of Wolbachia in the community must be monitored continuously to determine its impact on humans, local mosquitoes, and the ecosystem.

The impact of environmental heterogeneity on Wolbachia's dynamic spread in nature is rarely measured. Random epidemiological transitions can drive Wolbachia to extinction in homogeneous environments and are more effective if relocated. Increasing knowledge about Wolbachia technology in the community can be done to make the DHF disease control program successful. People's acceptance of this technology depends on their knowledge and understanding.

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