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UC researchers to test the genetic control of mosquitoes in India

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They have showed that the gene which prevents malaria transmission in the genetically modified mosquitoes canbe passed on to their offspring. This implies that, in several generations, the entire population of A.stephensi in the wild can potentially be replaced by one incapable of transmitting malaria.

India might become testing ground for a new but controversial technology that can wipe out malaria from the country, provided the technology of U.S. developers is approved by regulators.

Malaria is spread by female mosquitoes of genus Anopheles with several species capable of carrying the parasite. Using gene-editing technology, researchers at the University of California (UC) -- at its campuses in Irvine (UCI) and San Diego (UCSD) -- modified the Anopheles Stephensi mosquitoes to create a strain that resists infection by Plasmodium falciparum, the parasite that causes malaria.

And employing what is called "Gene Drive", they showed that the gene which prevents malaria transmission in these genetically modified (GM) mosquitoes can be passed on to their offspring. This implies that, in several generations, the entire population of A.stephensi in the wild can potentially be replaced by one incapable of transmitting malaria.

But, will this silver bullet that works in laboratory, perform in the real world?

That is what the US team is planning to find out using malaria endemic India as the test-bed for their experiment under a generous $70 million (Rs 460 crore) grant from India's Tata Trusts.

This is the largest foreign investment ever received by UCSD and 50 per cent more than the annual budget (Rs 300 crore) of National Vector Borne Disease Control Programme (NVBDCP) -- India's nodal agency for the control of all vector-borne diseases, not just malaria; reports IANS.

Suresh Subramani, professor of molecular biology at UCSD, says his team will work with a new Centre being created in India

at the Institute for Stem Cell Biology and Regenerative Medicine (InStem) in Bengaluru. The collaboration, he says, "Represents a fantastic opportunity to train scientists of Indian origin in the new technology of 'active genetics' for the benefit of society."

According to UCSD spokesman Mario Aguilera, "Gene Drive technology has not yet been applied for vector control anywhere." Field trials in India, if allowed, will be the world's first.

Some scientists like P.K. Rajagopalan, former head of Vector Control Research Centre in Puduchery, says GM mosquito field releases should never be allowed.

"I am 88 and have spent all my life with mosquitoes in the field," Rajagopalan told this correspondent. "Mosquitoes had evolved by natural selection long before man. To think one can replace the natural population with another is a pipe dream."

Rajagopalan noted that Sri Lanka controlled malaria "by super-active surveillance and hard field work, making the environment inhospitable for mosquito breeding. Nowhere in the world has anyone controlled mosquitoes or vector borne diseases using GM releases."

R.S. Sharma and A.C. Dhariwal, two former NVBDCP directors, agreed. "Now everybody is pushing their agenda without knowing the biology of vector diseases in the field," Sharma said.

Dhariwal wondered "why the Tata Trust is pumping money into a California University and not into the Indian Council of Medical Research". The Trust's chief trustee, R. Venkataramanan, did not reply to request for a comment.

Govindarajan Padmanabhan a renowned biochemist at the Indian Institute of Science in Bengaluru, is an ardent proponent of GM crops but is wary about Gene Drives.

"There are issues of stability of the genetic elements over generations and also potential for resistance development to the spread," he told this correspondent, adding: "The environmental and ecological consequences are also being debated globally and I am not sure release of such engineered mosquitoes would ever become a reality in India, where even the Bt brinjal embargo has not been lifted."

But not everyone is opposed. L.S. Shashidara, biology professor at Indian Institute of Science Engineering and Research (IISER) in Pune, does not want to throw the baby out with the bathwater.

"I am quite confident that this is a safe technology," he said. "Of course, it has to be proved beyond doubt. By not doing research itself, we may miss a great opportunity to help the society."

"This new approach is at a very early stage," admitted K. VijayRaghavan, Secretary, Department of Biotechnology, responsible for ensuring safety from the use of GM organisms. "Results from laboratory studies will determine how fruitful this approach is."

It is not the first time India is sought after as testing ground for release of GM mosquitoes. In 1975 a US-funded project that planned to release them at Sonepat in Haryana for control of dengue, was terminated by the then government on suspicion that the data collected from the experiment could have implications in biological warfare.

Since then, India has been wary about similar proposals under the banner of collaboration. Permission is pending foranother proposal by the British firm Oxitec for release of GM mosquitoes for controlling dengue.

Resistance to the field trial of the anti-malarial GM mosquitoes by the UCSD team is likely be fierce because of the unpredictability of Gene Drives and the potential they hold for altering entire ecosystems.

And, a recent report in the journal "Nature Methods" said: "Gene-editing technology can introduce hundreds of unintended mutations into the genome."

Recognising these pitfalls, the US National Academies of Sciences, Engineering, and Medicine said: "Gene Drive systems raise many questions with respect to their safety related to public and environmental health due to their intrinsic qualities of rapid spread and irreversibility."

The Convention on Biological Diversity has called for "a moratorium on development and release of genetically engineered

gene drives".

Gene Drives are also considered controversial because their self-propagating nature makes them an ideal tool in the hands of would-be bioterrorists to spread disease-causing organisms.

While consensus is still to emerge, the US team indicated it will not push this untested technology on unwilling people.Asked when the Indian field trial with his GM mosquitoes for malaria control will start, UCI vector biologist Anthony James told this correspondent: "It will depend entirely on community acceptance and the regulatory requirements. I do not have a way to put a date on these."