Microorganisms governing genetic makeup of mosquitoes; Threat to Human life!!!

Mosquitoes are the greatest threat in the rainy season, blameable for several millions of deaths due to cases of malaria, dengue and yellow fever worldwide. These devils also transmit other fatal diseases like lymphatic filariasis and Japanese encephalitis. Malaria is endemic in 91 countries, endangering the life of 40% world's population. By destabilisation of the health conditions and working capability of hundreds of millions, it is closely allied to poverty and low social and economic development. Dengue is the world's second utmost significant mosquito-borne virus disease, with 2500 million people globally at risk and 20 million cases a year in more than 100 countries.

Plasmodium's ability to alternate its host's behaviour help to elucidate its ability to infect so many individuals. Investigators have found that these alterations in insects contribute to differential attractiveness for the host. Infected mosquitoes take longer duration blood meals which are responsible for transmission of infection to human beings. It has been indicated that, while selecting a human host, mosquitoes have inclination for certain individuals.[1] For example, Anopheles gambiae which is principal malaria vector in Africa, prefers pregnant woman. Another example of host-parasite manipulation is seen in malaria infected people which becomes desired host for A. gambiae during the contagious phase of infection. Individuals with a greater body mass and high body temperature do appear to be more attractive to mosquitoes and bugs. Some researchers also claim that dietary consumption of garlic, vitamin B or beer have repellent action on mosquitoes.[2]

Host preference and host-seeking ability play crucial roles in disease transmission and are targets for intervention. Female mosquitoes use two volatile signs to select and traverse toward hosts: exhaled CO2 and human skin odorants. Odours such as lactic acid, ammonia, carboxylic acids, 1-octen-3-ol, and nonanal, increase mosquito attraction when combined with CO2. Since mosquitoes use odour to find their prey scientists have wondered whether this factor is responsible for endemicity of diseases and has some genetic basis behind it.

In 2007 a study was piloted in Netherlands to understand how the parasite affects mosquitoes' magnetism to people. They establish that a species of *Plasmodium* parasite that causes malaria in rodents can amend mosquitoes' olfactory proteins. Foot sweat from a volunteer who wore nylon stockings for 20 hours was placed in a cage with two groups of *Anopheles gambiae*. One group was infected with *Plasmodium falciparum*; the other wasn't. Infected mosquitoes landed on the fabric three times as frequently as did non-infected mosquitoes.[3]

Recently genetic basis behind the odour of individual which attracts the mosquito has become the subject of interest among the researchers. It is seen that the CO2-sensitive, Gr-expressing cpA olfactory neurons on the maxillary palps of mosquitoes are sensitive sensors of human skin odours in A. aegypti and A. gambiae. Only known ORN class in mosquitoes is the CO2 receptor neuron cpA whose activity closely correlates with behavioural attraction, it is assumed that volatiles from human skin may activate cpA. Various studies prove that the Gr1-, Gr2-, and Gr3-expressing cpA neurons on the maxillary palps of mosquitoes play a critical role in attraction toward humans by detecting both exhaled CO2 and odorants from skin.[4]

Understanding genetically-determined mechanisms that underlie disparity in the odour of human body and thus variation in frequency and duration of mosquito bites lead to the development of innovative methods to enhance the production of natural repellents, thus generating a novel repellent technology that could curtail the need for topical application.[5]

The researchers still don't know the actual mechanism, how the parasite manipulates mosquitoes' sense of smell. It's also indistinct which constituent of human odour is the most attractive to the mosquitoes. That facts could help researchers improve traps to catch infected mosquitoes.

"We're at the tip of the iceberg, really, of understanding all the strategies the parasite is using in the mosquitoes," says parasitologist Hilary Hurd of Keele University in England, who collaborates with some of the study's authors. "That's

remarkable, given that this is a single-celled organism we're talking about."[6]

Dr. Rohit Varshney
Editor in Chief

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