

Fungus enhances susceptibility of resistant malaria mosquito to pesticides

September 24 2009

In areas where malaria mosquitoes have become resistant to chemical pesticides, mosquito-killing fungi can be an effective tool. Fungal spores can effectively infect and kill malaria mosquitoes, even those that are resistant to pesticides. Moreover, the mosquitoes become more susceptible to the pesticides as the fungal infection increases.

Researchers from Wageningen University and their colleagues from South Africa have published an article on this effect in the prestigious journal *PNAS* (*Proceedings of the National Academy of Sciences*) of this week.

Malaria mosquitoes are becoming increasingly resistant to [pesticides](#). As a result, [malaria](#) is difficult to control. Besides the existing chemical pesticides such as DDT and pyrethroids, which are applied indoors and on mosquito nets, there are few options for mosquito control. The use of insect-killing fungi is a novel biological control method for malaria mosquitoes that was developed in 2005 in cooperation with Wageningen researchers. The spores of the fungi can infect mosquitoes upon contact and kill them within several days. Moreover, a [fungal infection](#) reduces the mosquito's appetite and slows the development of malaria parasites inside the mosquito.

Together with her colleagues in South Africa, the Wageningen researcher Marit Farenhorst tested these fungi for the first time on various species of pesticide-resistant malaria mosquitoes. In the laboratory in Johannesburg, the research team compared the effectiveness of fungi on mosquitoes that are susceptible to insecticides

and their relatives who are resistant. The fungus *Beauveria bassiana* was able to kill both susceptible and resistant malaria mosquitoes. This indicates that malaria mosquitoes that are resistant to the pesticide are not resistant to the fungus.

In addition, the team studied to what extent mosquitoes that are infected with the fungus are also susceptible to pesticides. To this end, resistant mosquitoes were infected with spores of the fungi *Beauveria bassiana* or *Metarhizium anisopliae*. After three days of incubation, they were tested for their resistance to the pesticides permethrin and DDT. Both fungus species increased the mosquitoes' susceptibility to these agents; more mosquitoes died after exposure to the chemicals when they were infected with fungus. The researchers believe that the toxins excreted by the fungi undermine the mosquitoes' resistance mechanism.

The results show the potential of fungi as an effective and sustainable biological control agent for malaria mosquitoes. Due to the increasing problem of pesticide resistance in Africa, they offer a crucial alternative for current control methods.

Because infected mosquitoes die slowly, within several days, they are still capable of reproducing. As a result, there is much less chance of their offspring becoming resistant to fungi. According to the researchers, the relatively slow effect of the fungi is sufficient to block transmission of malaria. On average, it takes 10-14 days before a mosquito that has acquired the malaria parasite during a blood meal can transmit the disease to another person. "In fact you only kill 'old' mosquitoes, and these are actually the most dangerous ones!", explains researcher Bart Knols.

Because fungi enhance the effectiveness of pesticides against resistant mosquitoes, the researchers see a fungus-pesticide combination as an important addition to the limited arsenal of anti-malaria weapons.

Worldwide, more than one million people die every year from malaria, primarily African children less than five years old and pregnant women. More than 3 billion people live in regions where there is a risk of malaria infection, and every year more than 500 million people suffer from an infection. The disease is transmitted by mosquitoes, and mosquito control takes place with mosquito nets that are treated with a pesticide or by applying pesticides to the indoor walls.

Resistance to the standard agents that are used for mosquito control, primarily resistance to the so-called pyrethroids that are used to impregnate mosquito netting, is becoming increasingly widespread, especially in West Africa. In some countries, such as Benin, treated mosquito nets and indoor spraying no longer offer sufficient protection. During the past 20 years, no chemical alternative has appeared on the market, and the possibilities for controlling the mosquitoes biologically (with fungi) is seen as a sustainable alternative to avoid resistance.

More information: Farenhorst, M., Mouatcho, J.C., Kikankie, C.K., Brooke, B.D., Hunt, R.H., Thomas, M.B., Koekemoer, L.L., Knols, B.G.J., Coetzee, M., 2009. “Fungal infection counters insecticide resistance in African malaria [mosquitoes](#)”. [Proceedings of the National Academy of Sciences USA](#).

Source: Wageningen University

Citation: Fungus enhances susceptibility of resistant malaria mosquito to pesticides (2009, September 24) retrieved 20 April 2024 from <https://phys.org/news/2009-09-fungus-susceptibility-resistant-malaria-mosquito.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.