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The smell of a chicken wards off one species of malaria-spreading mosquito—meaning the scent compounds, or the birds themselves, might help deter disease.

Our research found that chickens emit volatile chemical compounds that act as long range repellents. We refer to these compounds as spatial repellents. The mosquitoes are repelled by the chicken odours and will actively fly outside when they encounter them.

To put it simply, if there's a chicken or the smell of chickens' chemical compounds in a room, this particular mosquito buzzes off.

This is really intriguing in light of mosquitoes' growing resistance to traditional control programmes. It's important to stay one step ahead of these small but very deadly insects by developing additional tools to keep mosquitoes away from humans.

Our study showed that when the volatile compounds found in chickens are combined with established control programmes, such as sprays and nets, they have the ability to protect humans from the risk of mosquito-vectoring diseases.

What's unique about chickens?

Malaria mosquitoes have developed preferences for various human and animal hosts. The most severe vectors of malaria will feed almost exclusively on humans. Others have a wider preference, but will still be selective in their diet.

Mosquitoes use their sense of smell to both locate and avoid their blood hosts. We found that chickens emit both specific compounds and some compounds that were shared with livestock like cattle, sheep or goats. These repel *Anopheles arabiensis*, one of the primary vectors of malaria in Ethiopia.

We believe that the mosquitoes respond to these volatiles either because chickens actively feed on the mosquitoes or because the quality of chicken blood is inferior compared to that of livestock blood.

How was this discovery made?

We studied the host preference of *Anopheles arabiensis* by human and livestock surveys in three villages in Ethiopia. Combined with blood analysis of caught mosquitoes we found that they do not feed on chickens. This was despite the fact that chickens were the third most abundant species, following humans and cattle, in the villages.

By analysing the odours given off by the various animals and looking into what compounds mosquitoes were able to sense, we identified the chicken-derived repellent compounds. We synthesised the repellent compounds and tested them in houses with sleeping volunteers to see if they were able to deter host-seeking mosquitoes. Six of the identified compounds did, four of which were as repellent as a chicken.

We believe that chicken odours have the ability to repel *Anopheles arabiensis* throughout most of Africa. But this has to be validated through experiments. How effective these volatiles, or chickens that emit them, are in repelling other species of malaria mosquitoes should be tested next.

In Africa's battle against malaria, two low-tech tactics—insecticides and bed nets—have done a decent job killing off mosquitoes. "But it's mainly one species that's been affected. That's a species called *Anopheles gambiae*, sometimes called the African malaria mosquito." Rickard Ignell, a chemical ecologist at the Swedish University of Agricultural Sciences.

He says, despite that success, the problem is far from solved. For one, mosquitoes are developing resistance to insecticides. And two, there are many other species that can spread the disease. Including one that's common in the horn of Africa: *Anopheles arabiensis*.



Unlike the pickier *gambiae*, its palate is wide-ranging. *Arabiensis* sucks the blood of cattle, sheep, goats. But... not chickens. "First of all, chickens like mosquitoes. So they'll actively feed on mosquitoes and other insects. So avoiding chickens could be a way of surviving, and evolving a way of smelling the chickens could be an early warning system for them."

And it turns out, that aversion to chickens can be used against the insects. Ignell and his colleagues isolated chemical compounds from chicken feathers, and dispensed them next to a human sleeping under a bed net—a human lure. And they found that fewer mosquitoes came round for a snack, due to the repellent chemicals.

Ignell says this chicken cologne won't be immediately available. "Ideally the world would be like that, that we could bottle it up and send it off and they don't have to pay anything. But that's not the case obviously." Luckily, there's an equally effective substitute. "We can actually reduce the number of mosquitoes indoors by just using a chicken. So that's probably the cheapest option."