Maize and Malaria

In Africa, a robust new breed of maize yields a deadly new breed of mosquitoes

| From Explorations | By Vicky Waltz, Video by Devin Hahn

From 1973 to 1975, James McCann worked as a Peace Corps volunteer in Bure, a small farming village in the highlands of northwestern Ethiopia. At the time, malaria was ravaging much of the country, killing thousands, but McCann didn’t bother to take the antimalarial drug chloroquine. Bure was more than three miles above sea level, and the villagers believed its chilly air and high altitude kept the insects at bay.

But when McCann, now a College of Arts & Sciences professor of history, returned to Bure twenty years later, he found a village that had been devastated by malaria. “Churches and schools were abandoned,” he says. “People locked the doors of houses and said, ‘They’re all dead in there.’”

The Bure district’s 1998 malaria outbreak infected nearly 42,000 people, almost 40 percent of the population, and killed 700. Shocked and deeply troubled by the tragedy, McCann set out to determine why an area that had previously had no history of malaria had suddenly become a hotspot for the disease.

In fact, he already had a suspicion. While researching his 2005 book, *Maize and Grace: Africa’s Encounter with a New Crop*, McCann learned from a colleague at the Harvard School of Public Health that laboratory results had indicated a possible connection between increased levels of malaria and maize cultivation. He wondered if the crop that was meant to sustain Ethiopia’s people could also be helping to kill them.

During the summer of 2003, McCann met with epidemiologist Asnakew Kebede (GRS’08,’13), an Ethiopian Ministry of Health and World Health Organization employee, and the two traveled to twenty-one rural villages throughout the Bure district where cultivation had shifted to maize from more traditional crops, such as teff, barley, and sorghum. They found that the rate of malaria transmission among maize farmers was ten times higher than the transmission rate among those who farmed other crops.

Epidemiologist Asnakew Kebede (GRS’08,’13) (left) and CAS Professor James McCann learned that a move away from traditional crops like barley and sorghum to maize coincided with an explosion in cases of malaria. *Photo by Vernon Doucette*

The researchers suspected, and laboratory results confirmed, that the explanation for the difference lay in the powdery yellow substance that contains the plant’s reproductive cells. A maize field produces large amounts of pollen — about 300 pounds per hectare, or 2.5 acres. And mosquito larvae thrive on it. “Maize pollen is an accelerant for mosquito
populations,” McCann says. “They just explode. You may as well be putting kerosene on a fire.”

Kebede learned that mosquitoes that feed on maize as larvae tended to have a larger wingspan and a longer lifespan, and are therefore more likely to transmit malaria simply because they bite more people more times. “It’s unlikely that you’ll contract malaria after one or two bites,” Kebede says. “But these mosquitoes are living long enough to bite multiple times.”

McCann knew that maize had been grown for centuries, primarily as a garden vegetable. It wasn’t until the 1980s, when Ethiopia’s socialist military government pressed for broader cultivation, that it replaced more traditional grains as the country’s major crop. Between 1993 and 1998, maize cultivation increased by 79 percent nationwide, McCann says, and incidents of malaria rose with it. “As maize fields grew closer and closer to homesteads,” he says, “more and more farmers became infected.”

It was also around this time that the Ethiopian government introduced a new variety of maize, which sheds its pollen during late August and early September, weeks later than other varieties of maize and at precisely the time when temperature and moisture are ideal for mosquito breeding. By appearing later in the rainy season, McCann and Kebede explain, the pollen is less likely to be washed away at the time when mosquito larvae are more likely to have stable breeding sites.

The pollen produced healthier and more mobile mosquitoes, whose evolution coincided with a slight warming of the climate, leading to what McCann describes as “a perfect storm,” an ideal habitat for mosquitoes to breed and feed. Today, he says, while farmers and the Ethiopian government are aware of the connection between maize and malaria, they are reluctant to abandon the high yields of maize for lesser yields of their traditional crops.

One solution would have farmers grow a genetically modified variety of maize, whose pollen contains an insecticide that would kill mosquito larvae. But the costs of that would be beyond the means of local farmers, according to McCann. Another possible solution would involve detasseling — removing the pollen-producing tassel from a maize plant by hand and thus preventing pollination, but that is a time-consuming process.

A third option, he says, would be to encourage farmers to grow a maize variety that sheds its pollen earlier in the season, prior to peak mosquito development. Farmers could also plant their fields at least sixty meters from their homesteads, he adds, to create a buffer zone between the breeding grounds and the houses.

But the most logical solution, says McCann, is to encourage farmers to grow local varieties of self-pollinating grains, such as teff, or vegetables such as red pepper, near mosquito breeding grounds. “We are not suggesting that farmers stop growing maize,” McCann says. “We are simply suggesting that they grow it away from breeding grounds.”
McCann and Kebede hope to take their research beyond Ethiopia and apply it to other countries where both maize and malaria are prevalent. “Malaria is spreading to new areas of the developing world every day,” McCann says. “Within the next decade, it will be the number one crop in the world. And while maize doesn’t cause malaria, it most certainly accelerates it.”

“If we can do anything to help stop it,” Kebede says, “we will.”