Malaria-carrying parasites spread more when they can jump into multiple birds

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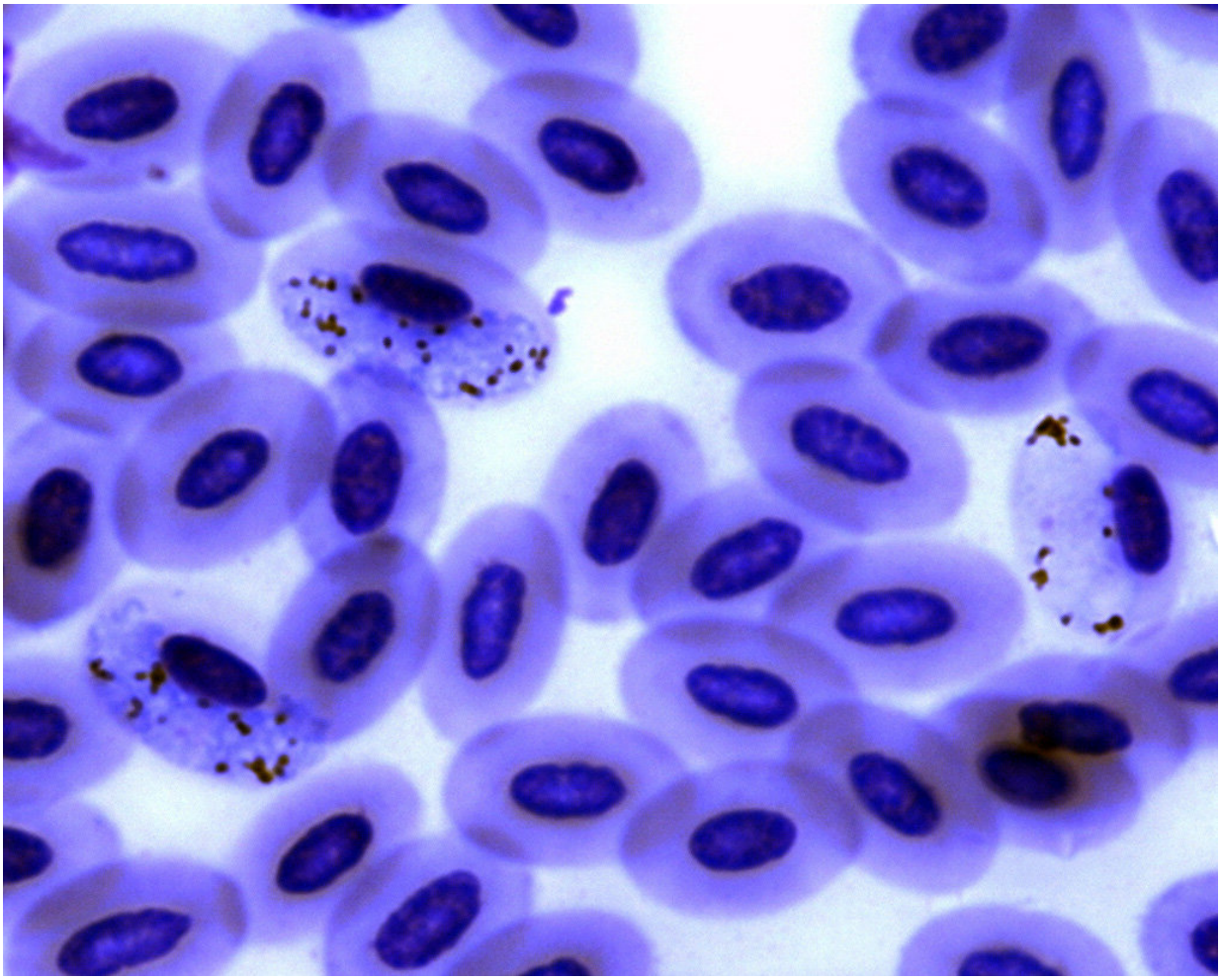

Plasmodium infecting a bird's blood cells. These parasites are 'generalists' and were found to be more spread out and diverse in the Amazon region. Credit: Jeff Bell.

If you're a parasite and want to spread out a little in Amazonia, then you better be cool with riding around in a variety of different birds, a new study found.

The Amazon region of South America is one of the most diverse tropical forest ecosystems on Earth, but an Academy of Natural Sciences of Drexel University study showed that in the blood parasites that cause malaria, bird hosts and the region's physical geography play significant roles in the spread and diversity of these parasites.

A team led by Alan Fecchio, a former postdoctoral researcher at the Academy, and Jason Weckstein, PhD, an associate curator of the Ornithology at the Academy and an associate professor in Drexel's College of Arts and Sciences, looked into two groups of haemosporidian parasites: *Plasmodium* and *Haemoproteus*.

"*Plasmodium* infection and distribution patterns are principally shaped by geography, whereas *Haemoproteus* patterns of diversity and distribution are primarily shaped by their host evolutionary relationships," Weckstein said of the findings from his study, published in *Ecography*.

They found that the ability to switch to new bird host species was the prime indicator of regional diversity in *haemosporidian* parasites. Furthermore, Fecchio and colleagues found that *Plasmodium*, in particular, were more widespread, which makes sense because they are "generalists" that can latch onto several different types of birds.

Amazonian motmot (*Momotus momota*), a carrier of *haemosporidian* parasites. Credit: Alan Fecchio.

Haemoproteus, however, are limited in the types of birds they can infect. As such, they don't get spread around very much.

But if *Plasmodium* can hop into a bunch of different birds, what keeps them from being everywhere in this region? Birds can fly anywhere, right?

Well, it's not as simple as that.

"Early 19th century Amazonian explorers Henry Walter Bates and Alfred Russel Wallace noted that major Amazonian rivers often appeared to form barriers to dispersal for birds, primates and other organisms," Weckstein said. "As a result, if one compares the faunas found in areas flanking most Amazonian rivers, a large portion of the species will be different on opposite banks."

Although the Amazon River is the most recognizable to most, there are many rivers in the Amazon region - such as the Xingu, the Tapajós and the Madeira. These make up roughly eight recognized areas of endemism in the region.

The ruddy ground dove (*Columbina talpacoti*), one of the few carriers of the *Haemoproteus* parasite. Credit: Jason Weckstein.

And, as it turns out, some of these birds just don't have the endurance to make the trip across these rivers. Others might just have no reason to.

"Some birds never leave the dark understory of the forest and, thus, will not even cross small rivers, streams or open pastures," Weckstein said. "Scientists have even conducted experiments and found that these understory birds fatigue and are unable to cross large expanses of open space, such as open water."

For comparison, some rivers in Amazonia are 10 to 20 times wider than the Delaware River at the spot where the Benjamin Franklin Bridge spans it in Philadelphia.

So even though *Plasmodiumcan* jump into multiple kinds of birds, if those birds are all staying put, so is the *Plasmodium*.

Although the study focused mainly on bird parasites, it provides another building block to understanding microorganisms that affect humans, too, like malaria. After all, human malarial parasites are also members of the *Plasmodium* genus.

"This work helps us to understand the transmission of these parasites between species and how that may play an important role in their evolution," Weckstein explained. "Thus, it helps us to characterize the ecology of pathogen dispersal and host switching events, which is critical to understanding many of our own human pathogens."

More information: Alan Fecchio et al, Diversification by host switching and dispersal shaped the diversity and distribution of avian malaria parasites in Amazonia, *Oikos* (2018). DOI: 10.1111/oik.05115

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