Medical Xpress

Pesticides increase the risk of schistosomiasis, a tropical disease

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Researchers examined 48 bodies of running water in Kenya for pesticide contamination, composition of the biological communities and occurrence of snails. Credit: @UFZ

Schistosomiasis is a severe infectious disease caused by parasitic worms.

As an intermediate host, freshwater snails play a central role in the life cycle of the parasite. In a recent study published in the journal *Scientific Reports*, researchers from the Helmholtz Centre for Environmental Research (UFZ) in cooperation with the Kenya-based International Centre of Insect Physiology and Ecology (icipe) succeeded in proving that snail populations in waterbodies contaminated with pesticides were significantly larger than in uncontaminated waterbodies. The pesticides used in agriculture may well be an outright driver for the risk of infection with schistosomiasis, the researchers warn.

According to WHO estimates, there are around 200 to 300 million people infected with schistosomiasis (also known as bilharzia) worldwide; around 200,000 die each year of the consequences. The disease also has far-reaching socio-economic effects in the tropical regions concerned: infected individuals are often unable to work and children are too weak to be able to go to school. It is transmitted through the skin following exposure to infected water. The pathogen is a parasitic trematode worm of the genus Schistosoma—the "blood fluke". To date, five different kinds of Schistosoma that can infest humans have been identified.

Around two centimetres in length, the worms become lodged in the intestinal wall, the bladder or the liver. The consequences include inflammation and severe organ damage that can lead to death. Schistosomiasis can be treated with an anti-worm medication. But treatment does not protect against reinfection. "Contaminated waterbodies are the problem," says Professor Matthias Liess, Head of the Department of System Ecotoxicology at the UFZ. "Before schistosomiasis can be contained, something has to be done to prevent the proliferation of the pathogens in bodies of water."

Matthias Liess and his team at the UFZ are carrying out research into how pesticides affect biological communities in bodies of running water.

"Sensitive insect species disappear whereas the populations of more resistant species such as freshwater snails proliferate—and this starts happening even at extremely small concentrations of pesticides that are deemed harmless in the pertinent risk assessment," Liess explains. "In tropical waterbodies—and even in Corsica since 2011—freshwater snails play a central role as an intermediate host in the life cycle of the parasitic trematode worm. If its eggs enter a waterbody through the excreta of infected persons, miracidia (larvae) hatch in the water and then reproduce asexually in freshwater snails. One larva can produce several thousand cercariae, the next larval stage, which then pass into the water. If they reach a human host, they penetrate through the skin into the body, where they develop into adult worms.

In their recent study sponsored by the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation), the researchers participated in field studies to examine 48 bodies of running water in the environs of Kenya's Lake Victoria for pesticide contamination, composition of biological communities and occurrence of snails. "It became apparent that in those places where there was no pesticide contamination and the biological community of the waterbody was in a natural balance there were only few snails," says Liess. "If it was possible to detect pesticides in the waterbody, the communities were dominated by snail populations ." Laboratory tests further revealed that the species of snails that act as an intermediate host in the life cycle of the trematode worm Schistosoma were extremely tolerant of high concentrations of pesticides.

Using model studies, the researchers looked for additional factors that favour snails in ecosystems contaminated with pesticides. It was revealed that the snail populations grow predominantly due to the lack of food competitors. "Insect larvae living in the water that graze the algae cover of rocks, just like the snails, are severely decimated by pesticide contamination or disappear completely. This results in optimum food

conditions for the snails, which allows them to proliferate," Liess explains. "And the large number of potential intermediate hosts is, in turn, ideal for the trematode worm Schistosoma to spread."

One measure that would help reduce the level of schistosomiasis pathogen contamination of waterbodies in the affected regions is the construction of effective sewage plants, which would reduce the input of untreated, contaminated wastewater. But, on its own, this measure would not be sufficient in the researchers' opinion. "Even if only a few pathogens enter the water but meet with a huge snail population there, the problem is still unresolved," says Liess. "For this reason, it is important to make adjustments to both parameters and take measures to reduce pesticide contamination in order to effectively contain the risk of contracting schistosomiasis." For example, creating buffer strips adjacent to agricultural land or dispensing with the use of pesticides in the direct vicinity of waterbodies would promote significant shifts in the composition of species towards a natural biological community with only few snails, say the researchers.

"With our study, we were able to clearly demonstrate that even low pesticide concentrations constitute a serious environmental risk and, in this respect, not only contribute to the decline in insect populations but also indirectly promote dangerous diseases in humans," says Liess. "We hope that our findings will contribute to reducing or avoiding the future use of pesticides near waterbodies in schistosomiasis hotspots and thus making it possible to lower the risk of infection."

More information: Jeremias M. Becker et al, Pesticide pollution in freshwater paves the way for schistosomiasis transmission, *Scientific Reports* (2020). DOI: 10.1038/s41598-020-60654-7