

African parasite that spreads poverty by killing cattle tamed by its less lethal cousins

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African cattle infected with a lethal parasite that kills one million cows per year are less likely to die when co-infected with the parasite's milder cousin, according to a new study published today in *Science Advances*. The findings suggest that "fighting fire with fire" is a strategy that might work against a range of parasitic diseases.

The immediate implications are for the battle in Africa against a tick-borne cattle-killing parasite, *Theileria parva*, which causes East Coast fever. The disease kills one cow every 30 seconds and claims US\$300 million in livestock losses each year, mostly from poor herders who can scarcely afford to lose even a single animal.

"Our results suggest seeking a simple vaccine that could protect cows from East Coast fever by inoculating them with a related but far less harmful parasite," said lead author Mark Woolhouse, who is with the University of Edinburgh, in the United Kingdom. "It has been suggested that a similar process might be at work in malaria, where infection with the less harmful *Plasmodium vivax* parasite may protect people from the *Plasmodium falciparum* parasite that kills almost 600,000 people each year."

The study, Co-infections determine patterns of mortality in a population exposed to parasite infections, was conducted as part of an Infectious Diseases of East African Livestock (IDEAL) project, a multi-partner study that includes the Nairobi-based International Livestock Research Institute (ILRI). The project followed more than 500 indigenous East

African shorthorn zebu calves during their first year of life.

The calves live in a part of Western Kenya where they are routinely exposed to both the *T. parva* parasite and its less aggressive relatives. *T. parva* causes high fever and, like cancer, promotes uncontrollable proliferation of white blood cells. Its relatively innocuous cousins, such as *Theileria mutans*, typically cause chronic but mild infections that may have no symptoms at all. The researchers discovered that co-infection with a lesser parasite was associated with an impressive 89 percent reduction in deaths from East Coast fever.

"This is an important finding; East Coast fever is a major burden for millions of poor people in Africa whose existence depends on healthy cattle," said Phil Toye, of ILRI, which is leading an international effort to develop a new vaccine against the disease. "The control methods now available are very expensive for most farmers and herders, and if we could provide a cheaper approach, it could greatly reduce poverty in the region."

Hope for Healthier Animals

ILRI experts are concerned that East Coast fever is spreading rapidly; it already threatens some 30 million cattle in East and Central Africa. In 2013, death and disease from this parasite caused US\$300 million in losses, challenging the livelihoods of pastoralist herders and farmers in this region. East Coast fever also impedes economic development for livestock keepers by limiting their adoption of more productive cattle breeds, which are even more susceptible to the disease.

The researchers say that these new findings about East Coast fever could explain why European cattle breeds raised in the same region as the indigenous shorthorn Zebu are more likely to die from *T. parva* infections: because the European cattle are managed in ways that reduce

their exposure to all tick-borne infections, they don't get the benefit of infection with the less harmful parasite. The findings could also explain why spraying cattle with a pesticide that reduces exposure to all *Theileria parasites* may have little effect on the overall burden of disease.

The only existing vaccine against East Coast fever is made by grinding up ticks that carry the *T. parva* parasite. This so-called "live vaccine" is costly to produce and deliver, and it induces an infection in the cows that must be treated with expensive antibiotics. The new study suggests that a simpler and cheaper vaccine might be based on more benign species of *Theileria*, which could also protect animals against disease but without the need for expensive drug treatment.

Lessons for Malaria

The [protective effect](#) against East Coast fever that appears to be provided by the milder parasites could be relevant to the fight against malaria. Like East Coast fever, malaria is caused by a single-celled parasite, *Plasmodium*, although more than one species of *Plasmodium* can cause malaria. The deadliest species is *Plasmodium falciparum*, whereas *Plasmodium vivax* is more widespread but causes less severe disease.

The researchers refer back to a 1996 study suggesting that protective effect of *P. vivax* could explain a genetic mutation common in people who live in the South Pacific that makes them susceptible to *P. vivax*: the people may be more vulnerable to *P. vivax* because it protects against the deadlier *P. falciparum*.

"A protective effect of *P. vivax* could explain why bednets used in places where both parasites are common are less effective in reducing malaria deaths than when used in places where *P. falciparum* is dominant," Woolhouse said. "A better understanding of how this milder parasite

may protect against the more lethal form of the disease could generate new approaches to reducing severe illness and deaths from malaria."

More information: "Co-infections determine patterns of mortality in a population exposed to parasite infection,"

advances.sciencemag.org/content/1/2/e1400026

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