Malaria parasites shun sex when nutrients are low

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When food is scarce, many animals need to choose when to conserve energy and survive and when to spend energy reproducing. New research from the University of Edinburgh shows that malarial parasites gather information from their environment to strike a delicate balance between the two.

Malarial parasites cause some of the most serious infectious diseases of humans, wildlife and livestock. The disease is caused by single-celled parasites that replicate in the red blood cells of their host. This replication is asexual when living within a host, but the parasite produces sexual forms in order to be transmitted between hosts. Increasing our knowledge of how parasites change their growth pattern depending on their environment is important for understanding the key concepts of disease action and transmission.

New research published in 'The American Naturalist' shows that Plasmodium chabaudi, a malarial parasite that infects rodents, is able to detect both the presence of competing parasites and the availability of red blood cells. This allows the parasite to determine when it is favourable to change from asexual replication to the sexual transmission form.

The researchers showed that mixed infections, which involve multiple strains of parasite, lead to reduced levels of the sexual form present in blood. Mixed parasite infections are widespread in natural populations - and it is likely that by trying to move between hosts less, the parasites are able to invest more energy in asexual reproduction, increasing their ability to compete for the red blood cells they need to survive.

Another possible explanation is that the presence of multiple strains of parasite results in a stronger host immune response - which is potentially damaging for all the parasites. By saving energy and maintaining asexual reproduction, the parasites may be afforded 'safety in numbers', allowing them to resist the immune response and continue to compete for resources.

The work also showed that the higher the number of uninfected red blood cells, the more likely the parasites were to invest in sexual reproduction, as nutrients were more plentiful.

The authors stress that there may be complications translating the results from

the rodent malaria parasite to the human form Plasmodium falciparum because they have different mechanisms of infection.

The results of this study have answered one of the long-standing questions in malaria biology - why so few transmission stages are produced during an infection. When fighting for survival, parasites simply can't afford them.

Reference

Pollitt, LC et al. (2011) Competition and the evolution of reproductive restraint in malaria parasites. The American Naturalist, 3: 358-67

Image: Plasmodium vivax, a malaria-causing parasite. Credit: Wellcome Images.

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Wellcome Trust, Gibbs Building, 215 Euston Road, London NW1 2BE, UK T:+44 (0)20 7611 8888