Tiny microbe turns tropical butterfly into male killer, scientists discover

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Tiny microbe turns tropical butterfly into male killer. Credit: University of Exeter

A scientist from the University of Exeter has helped to identify a male-killing microbe in a tropical butterfly called the African Queen, which leads to the death of all sons when a mother is infected.

In most of Africa this microbe, called *Spiroplasma*, infects African Queen butterflies but has no effect on their offspring. However, in a narrow zone around Nairobi in Kenya, where two sub species of butterfly live and breed, the scientists noted that the microbe infection caused all their sons to die. In fact the male eggs never hatch and are often consumed by their hungry sisters.

The authors of the paper, published in the Royal Society journal *Proceedings of the Royal Society B*, believe that the phenomenon, which takes place where two sub species meet, is the first step in the transition of the two sub-species into two true, non-interbreeding, species.

Professor Richard ffrench-Constant, from the Centre for Ecology and Conservation at the University of Exeter's Cornwall campus, and a team of British, Kenyan and German scientists, have found that the chromosomes of the females in which male-killing occurs have changed dramatically with a non sex chromosome fusing with a sex chromosome to form a new chromosome called 'neo W'.

Professor ffrench-Constant, Professor of Molecular Natural History, said: "We tend to think of new species coming about due to environmental changes but here its clearly the microbe that is driving these two sub species apart.

"Whilst we don't understand the precise molecular mechanisms behind this chromosomal merger, this means that no males are made in the hybrid zone, and that mating success in the zone is effectively zero, thereby creating a barrier with a new species on either side."

This paper represents the culmination of 13 years of field work in which the sex and colour pattern of butterflies around Nairobi was painstakingly recorded by a team led by Dr Ian Gordon based in Nairobi. The breakthrough came when female butterflies from the all- female zone were sent to Germany to have their chromosomes examined and where Professor Walther Traut from the University of Lübbek discovered that two of the chromosomes had fused.

Dr David Smith, formerly from the Natural History Museum at Eton College, first author on the paper, said: "The neo-W effectively acts as a genetic sink for all males, and butterfly populations around Nairobi are nearly all female. Our results demonstrate how a complex interplay between sex, colour pattern, male-killing and chromosomes has set up a genetic 'sink' that keeps two subspecies apart."

Professor Walther Traut, from the University of Lübbek, said: "This is like a smoking gun for the way in which species become distinct. It is rare that we can find the molecular basis for how species develop."

Professor ffrench-Constant added: "It appears that the butterfly's susceptibility to the male-killing microbe is driving the separation of the two butterflies into two true species. These tiny microbes are therefore having a major effect on sex and death in this fascinating butterfly."

More information: A neo-W chromosome in a tropical butterfly links colour pattern, male-killing and speciation by David A. S. Smith, Ian J. Gordon, Walther Traut, Jeremy Herren,Steve Collins, Dino J. Martins, Kennedy Saitot, Piera Ireri and Richard Ffrench-Constant is published in *Proceedings of the Royal Society B*: rspb.royalsocietypublishing.or … .1098/rspb.2016.0821

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