

How does bluetongue virus survive through the winter?

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In 2006, Bluetongue virus – which infects livestock – reached Northern Europe for the first time. Some people thought that the outbreak would be limited to that particular year, as winter was expected to kill off the midges that host and spread the disease, bringing the threat of infection to an end. In actuality, the disease escalated in the following year, spreading to the UK. So, how did the virus survive the winter?

Drs Anthony Wilson, Karin Darpel and Philip Mellor of the Institute for Animal Health have discussed this puzzling question in an Unsolved Mystery article, published in the open access journal *PLoS Biology*, freely available to read from publication on the 26th of August.

The answer to this question is of great practical importance, as it will affect both national and international trade of Ruminants, the livestock susceptible to infection, and will dictate trade rules for a long time even after the infection has passed. The answer is also relevant to how we can deal with bluetongue and other unpleasant midge-transmitted diseases in the future.

Dr Mellor said: "Although the major mechanism of bluetongue virus spread is undoubtedly that of *Culicoides* midges feeding on infected ruminants, growing the virus and then transmitting it to further susceptible animals, other mechanisms may also be at work. These may assume greater importance during the midge-free season (winter), such as we in northern latitudes experience."

Wilson and colleagues point out that evidence to date does not support the winter survival of bluetongue virus in the eggs of *Culicoides* midges. An alternative hypothesis is that, in mild winters such as that of 2006-07 in northern Europe, sufficient infected midges might survive until they become active again in spring. The midges may enter livestock barns to overwinter. Two other possibilities for disease endurance during winter are that bluetongue is spread by some susceptible species of long-lived ticks and/or by simple mechanical transmission by *Melophagus ovinus*, a wingless parasite that lives in the fleece of sheep.

Additionally, there is evidence from Australia that bluetongue virus can survive in midges and in a small proportion of infected cattle for three to four months, which would be long enough for winter to come and go without killing the virus.

Closer to home, the recent outbreaks of bluetongue in northern Europe have provided evidence for a different overwinter route—transplacental infections; the virus spreading from an infected pregnant animal to its fetus, a phenomenon also demonstrated by experiment. This phenomenon might be particularly important in cattle, where the long gestation period of nine months (four for sheep) means that the virus can grow and survive within a fetus, at just the right temperature, throughout the coldest of winters. There is also circumstantial evidence that cattle could become infected orally if they eat the afterbirth of an infected offspring from another cow.

As Dr. Mellor summarizes, "Experiments have revealed a toolbox of possible mechanisms, with the potential to interact with and complement one another."

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