Understanding midges helps control spread

CONTROL of the midge disease vectors will still play a significant role in reducing the spread of bluetongue, according to speakers at Intervet's bluetongue symposium held in Brussels.

It only takes one midge bite to transfer the bluetongue virus to a susceptible animal. But ideal breeding conditions can lead to a population explosion, resulting in hundreds of thousands of female midges looking for blood meals, spreading the disease and transmitting higher viral loads to ruminants.

VETERINARY Practice reports on a recent international symposium

It is widely accepted that higher temperatures increase the proportion of the midge population able to transmit the virus. Dr Chris Oura, head of the European Community reference laboratory for bluetongue at the Institute of Animal Health in Pirbright in Surrey, says that at 28°C it takes just three days for the virus to replicate inside the midge; at 15°C it's three weeks.

"Humidity also affects survival rate – midges don't like a dry environment because they desiccate. They need damp areas for breeding sites; hence precipitation influences the presence, size and duration of breeding sites. Wind is the key factor in vector dispersal and distribution, taking infection with it," he explains.

Dr Oura believes conditions in 2006 were ideal for the midge, yet he thinks it may not have been the first time the bluetongue virus had hit northern Europe. It had just never taken hold before. "Our summers are now more able to perpetuate BTV. One of the major bluetongue transmitting midge species (*Culicoides imicola*) is now being recorded more than 700km further north than in 1999."

Dr Chris Oura.

The bluetongue virus has not only migrated northwards to the extent of *C. imicola*'s distribution but, more worryingly, beyond it. This has occurred because of the "baton effect" where the overlapping of different species has led to the transfer of virus from *C. imicola* to new species, such as *C. pulicaris* and *C. obsoletus*, which have a more northerly distribution.

Unfortunately, midges aren't a major food source for any animal or bird, and bats don't eat enough of them to make a significant impact on numbers. Biological control, therefore, is impossible. However, permanent UV light traps to remove feeding females, use of insecticides and regularly cleaning silage pits, dung heaps and livestock housing can help control the vector and improve vaccination efficacy, said Professor Eric Haubruge from the Department of Functional and Evolutionary Entomology at Gembloux Agricultural University in Belgium.

Outbreaks studied

He studied 29 outbreak sites in Belgium between March and December 2007, catching 27 midge species, of which nine were potential BTV vectors. "Some 67% were *C. obsoletus* appearing as early as 1st and 2nd March, followed by *C. pulicaris* (6.1%) on 3rd March and *C. punctatus* (5.2%) on 4th March. Between 5th and 9th April, five other BTV vectors appeared: *C. chiopterus*, *C. dewulfi*, *C. nubeculosis*, *C. riethr* and *C. impunctatus*. Their activity period lasted until at least September for the first six species," he said.

Studies into the over-wintering habits of the midge in livestock housing suggest they are able to survive a European winter with temperatures between 5°C and 10°C. Controlling these midges early in the season will help reduce the number of females able to lay eggs, thereby potentially having a knock-on effect on populations later in the season.

In Britain, midge populations increase in May/June and again in September/October, with greatest activity at dawn and dusk. Some breed in wet leaf litter, others in mud, silage, dung, stream banks or floating vegetation on lakes. Midge larvae need a certain amount of water to complete their life-cycle. Eggs hatch after 3-7 days; the larval stage lasts 2-4 weeks; and adults live 1-4 weeks. So, with a quick life-cycle, ample potential breeding grounds and a body size less than 3mm, on-farm midge control isn't easy.

There have been mixed messages from countries such as Holland and Germany as to the effectiveness of housing livestock at dawn and dusk to protect them from midge attack. But keeping stock away from low-lying damp grazing makes sense as it is standard fly control practice.

DEFRA is also advising that dung heaps or slurry pits should be covered or removed, and their perimeters regularly scraped to a depth of 6-10cm, as this is where the majority of midge larvae are found. And there are also midge traps which work by attracting biting females (releasing carbon dioxide which mimics a human or animal) then desiccating them in a trap.

There is also a licensed deltamethrin-based insecticide that has proven efficacy against midges. Butox Swish (Intervet) was trialled in Germany last summer and found to kill midges for at least four weeks at preferred biting sites on the animal distant from the site of application, says trial director Professor Heinz Mehlhorn from the Heinrich-Heine University in Düsseldorf.

The trial used six heifers (each weighing around 400kg) treated with 30ml Butox Swish (the standard fly dose). Two untreated heifers were also studied for comparison. During the five-week period, contact between midges and treated hair caused immediate paralysis.

The midges then died at varying intervals depending on contact time and the number of days post-treatment, verifying the effectiveness of a monthly application of the product in cattle at the standard dose.

Modern technology could also help vets and farmers to predict the arrival of the BTV risk period as scientists develop geographical information systems to monitor midges.

According to Dr Laura Rinaldi from the University of Naples Department of Pathology and Animal Health, Italy, such systems have yet to finalise the exact requirements of the midge vectors, but could be available within two years. Distribution models work on suitable moisture availability reflecting the temperature and humidity necessary for egg laying, larval and pupal development.

The Swish applicator.

MIDGE FACTS

- Optimum temperature for the midge lifecycle is 15°C to 30°C.
- Activity rates increase especially at night but are inhibited at 8-10°C and above 30°C.
- Temperature affects lifecycle, ability to infect livestock and the rate of virogenesis within individuals.
- Adult midges can be dispersed passively on the wind. Wind speeds below 8kmh (5mph) are particularly favourable.
- Midges tend to stay close to breeding grounds.
- They can't fly when the wind speed exceeds 8.8kmh (5.5miles/hour)
- Attracted to dark coloured objects and carbon dioxide – animal and human breath.
- Can also detect acetone and lactic acid in human and animal body odour.
- Midges need a wet medium to reproduce and lay eggs.
- Females typically take a blood meal every 3-4 days.