1. INTRODUCTION

Bluetongue (BT) is an arthropod-borne viral non-contagious disease of domestic and wild ruminants, particularly affecting sheep with severe clinical disease including mortality. At present 24 different BT-serotypes have been identified and the disease is transmitted by biting midges (Culicoides). BT has a worldwide distribution between approximate latitudes 35°S and 40°N, although in parts of western North America, China and in Kazakhstan BTV may extend up to almost 50°N. This part of the world contains the habitat of *C. imicola*, the most important BT-vector of the *Culicoides* spp. BT is endemic in southern member-states of the European Union (EU), and several new incursions have been seen in Italy, Greece, Turkey, the island of Corsica, the islands of Menorca and Mallorca and Portugal. BT-serotypes 1, 2, 4, 9 and 16 were involved in epidemics in the EU member-states. Starting August 2006 a major epidemic of BTV serotype 8 was diagnosed in the North-Western part of Europe, affecting The Netherlands, Belgium, Germany and the North of France. The precise route of introduction remains unknown (Mintiens, 2007), but is clear that the incursion of the virus was a very exceptional event. Many hoped that during the winter season we would get rid of BTV-8, assuming that the chain of transmission would be broken by dying off of infected vectors and cessation of viraemia in infected ruminants. However, in the course of 2007 it became evident that BTV-8 somehow survived the winter in North-West Europe and a re-emerging epidemic spread exponentially within the original affected countries (Belgium, Germany, France, Luxembourg and The Netherlands), affecting ten thousands of holdings with ruminants (e.g. in Belgium and the Netherlands more than respectively 5,000 and 6,000 holdings with ruminants were affected at the end of November 2007). Besides that, BTV-8 was introduced into the United Kingdom, Denmark and Switzerland (promed, 2007a). The scale of the epidemic in 2007 is so huge that vaccination as a control option is (now taken very) seriously considered within the European Union (promed, 2007b).

2. FIRST NEW BTV-8 OUTBREAKS IN WESTERN EUROPE IN 2007

The very first outbreak in the originally affected area in Western Europe was reported from Germany in May 2007 when a sentinel cow tested positive in the state of North-Rhein Westphalia, followed by reporting of clinical disease (BTV-8 confirmed) in sheep in Belgium on 17 July. A cow without clinical signs tested positive (PCR) while tested for export purposes in France on 19 July 2007. So, it seemed that at several different locations within the originally BT-affected area, new infections popped up.

3. SITUATION IN THE NETHERLANDS IN 2007

In the spring of 2007, a cross-sectional study was executed in the Netherlands to get an impression of the seroprevalence in cattle in different compartments within the Netherlands. The bluetongue prevalence in 2006 was highest in the southern part of the Netherlands, with a gradient decreasing towards the Northern part; more than 50% of the compartments within the Netherlands were at zero or negligible prevalence (Vellema et al., 2007). The BTV-8 outbreaks in the Netherlands in 2006 caused 2.5% morbidity (defined as sum of total number of cattle affected relative to the sum of the total number of cattle present in outbreak herds) and 0.22% mortality (defined as sum of total number of cattle that died relative to the sum of the total number of cattle present in outbreak flocks) in cattle, and 7.7% morbidity and 4.4% mortality in sheep, while 50% of the sick sheep died...
Therefore, the overall conclusion at the end of the 2006-epidemic season was that the clinical consequences were considered as relatively mild in cattle and fairly moderate in sheep.

The first new BTV-8 outbreak in the Netherlands was reported on 26 July 2007 in the province of North Brabant in the southern part of the Netherlands: a cow without clinical signs tested positive (PCR) while tested for export purposes. That was the start of an exponentially increasing epidemic, spreading from the South towards the North, East and West of the Netherlands. The overall trend of the epidemic curve indicates a continuing increase in the total number of outbreaks, with a peak in mid-September (week 38).

From week 39 on, the number of new reported outbreaks has continually decreased. About an equal number of sheep and cattle holdings reported clinical BT problems in their animals.

During the 2006-epidemic in North-West Europe, no clinically affected goats were reported. However, in week 35 of 2007 the first clinical disease in goats caused by BTV-8 was reported from the Netherlands (Dercsen et al., 2007): in a holding containing 600 Dutch milking goats, 10 goats demonstrated clinical signs of bluetongue, starting with acute drop in milk yield and pyrexia, followed by edema of lips and face, crusts on lips and muzzle, nasal discharge, conjunctivitis and erythema of the udder. Up to week 44 a total of 25 holdings reported clinical disease (BT indicative) in goats.

In 2007, farmers suggested a more severe clinical situation on their farms compared to 2006. This may be explained by a higher number of animals within herds clinically affected compared to 2006. The rendering organisation Rendac in the Netherlands indicated that in August, September and October 2007 respectively 50%, 100% and 10% more sheep cadavers were collected from sheep farms than usual (2,000-2,500 sheep cadavers per week). In October, Rendac indicated that 5% more cattle cadavers were supplied by cattle farms than usually done (6000-6,500 cattle cadavers per week). This is an indication that the 2007-epidemic has a much more severe impact – more affected animals per holding but not necessarily more severe disease within individual animals - compared to the situation in 2006, in which no measurable increase in supply of sheep and cattle cadavers from farms was noticed.

Preliminary results from a longitudinal study in the southern part of the Netherlands (a cooperation between CIDC-Lelystad, Faculty of Veterinary Medicine of the University of Utrecht and Veterinary Practice Heerlen) on 5 cattle herds and 5 sheep flocks show indications that a large number of animals within these farms became infected (PCR and serology positive) in the second half of 2007, and these animals were serological and PCR negative in the Spring of 2007. Animals that were infected in the 2006 epidemic season - and as a result were serological positive in the Spring of 2007 - did not became infected (no PCR positives) again in the Autumn of 2007.

4. SITUATION IN BELGIUM IN 2007

In Belgium, a cross-sectional study to establish the spread of the virus after the 2006 epidemic was performed in winter 2007 (Méroc et al., 2007). As in the Netherlands, a gradient in the herd and within herd prevalence was
found decreasing from the ‘area of first infection’ around Maastricht-Liège, towards the other parts of Belgium (figure 2).

The first case of the Belgian 2007 BTV-epidemic was reported in a herd located in East Flanders (Olsene). This case was the starting point of a new wave of BT outbreaks in Belgium. The epidemic expanded is such way that within the two first months four times more cases were identified than during the entire 2006 episode. Although the first cases in 2007 mainly occurred in areas with low within-herd prevalence, it soon became clear that the incidence was most probably related to the population density of the susceptible hosts.

At the end of the epizootic in 2006, the case-herd species distribution was nearly identical with 57.3% of sheep herds and 42.7% of cattle herds. Investigations were made in 2006 in the Dutch infected cattle herds and showed that 64.7% were of dairy type (Elbers et al., 2007). The same distribution were again for in 2007 in Belgium.

For 1014 case-herds, the outbreak was further investigated: total numbers of animals that died or were slaughtered because of BT as well as animals that developed BT clinical symptoms were recorded. Clinical prevalence (number of clinically affected animals in a herd divided by the total number of animals at risk) ranged between 0 and 100% in both species case-herds. The overall clinical prevalence in ovine and bovine species was respectively estimated at 27.3 and 6.8%. The mortality rate was estimated at respectively 11.2 % and 0.6% in ovine and bovine species. No mortality was observed in 44% of the ovine flocks and 84% of the cattle herds. In sheep flocks, overall case fatality was 43.2 (range 0 – 100%). In cattle herds, overall case fatality was 6.29 (range 0-100%). In order to get more reliable information on mortality in Belgium in 2007, rendering plant data since 2005 were required and plotted in figure 3. When comparing with previous mortality patterns, the unusual increase of mortality in small ruminant population since the beginning of August (week 31) reflects clearly. This makes that a serious economical impact of the epidemic can be expected.

Figure 2. Distribution of within-herd-seroprevalence in Belgium according to the results of the winter screening, Belgium, January 2007 (Méroc et al., 2007).
5. CULICOIDES VECTORS

In 2006, BTV-8 spread across 5 Member States (MS’s) and by December 2006 had affected an area of approximately 170,000 km². At least 2 species of _Culicoides_, i.e. _C. obsoletus_ and _C. dewulfi_, were shown to be involved in its transmission. All affected MSs initiated national entomological surveillance programmes with the result that _Culicoides_ are now monitored widely using mainly Onderstepoort-type blacklight traps. The most significant findings made over the past year are summarised and discussed with emphasis on The Netherlands, where 20 farms are sampled weekly.

• _Culicoides_ activity during the winter months of 2006-7: In the Netherlands and in Belgium, low numbers of _Culicoides_ (almost exclusively of the Obsoletus Complex and excluding _C. dewulfi_) were captured almost each week between January and March 2007; 99 percent were freshly emerged nullipars, indicating that low-level breeding had continued throughout the winter.

• How did BTV-8 survived the winter between 2006 and 2007? Between January and March 2007 (plus or minus 90 days) the absence of older parous, potentially BTV-infected, previous-season adult midges in light trap collections led to the (false!) hope that BTV would not survive the winter. However, its ferocious recrudescence in 2007 invites many questions, which are discussed.

• More _Culicoides_ in a cooler and wetter 2007: The average number of vectors captured in Holland in 2007 is approximately 10-fold greater than the number collected in 2006, despite it being cooler and wetter and quite unlike last year [2006] (the hottest on record since measurements began in 1706). This would indicate that warmer winters and moderate, normal summers favour vector proliferation and perhaps also allow viruses previously exotic to Europe to become endemic there.

• Marked changes in some vector _Culicoides_ abundances: the Obsoletus Complex is the most prevalent vector in the Netherlands and dominant on half the farms surveyed. However, in parts of the southern Netherlands, _C. dewulfi_ has this year [2007] superseded _C. obsoletus_. If a similar reversal has occurred also elsewhere in Europe, it may in part explain the intensity of the current outbreak.

• Diurnal biting activity in _Culicoides_: _C. dewulfi_ and _C. obsoletus_ attack livestock in broad daylight while they are at pasture, especially on overcast days. Aggravating the situation, they also enter animal houses after dark. Therefore, the attack of livestock by day and at night, both indoors and outdoors, complicates our fight against BT. At this stage, vector control seems to hold little promise for halting the spread of the disease.
6. CONCLUSIONS

In 2007, BTV-8 continued to spread, including a jump across the English channel. The BTV-8 restriction zone now covers an area of almost one million km$^2$. There are no obvious geographical or topographic boundaries that might halt the advance of BTV-8, making it likely that it will continue in 2008 (and beyond) until it reaches the (as yet unknown) limits of its range. This is daunting when it is considered that vector _Culicoides_ (and susceptible ruminant hosts) occur across the entire Holarctic Region, which includes the Mediterranean Basin where _C. imicola_ lies in waiting, and North America, where outbreaks of BTV and Epizootic Haemorrhagic Disease of Deer virus (EHDV, another _Culicoides_-borne pathogen) are occurring also. In this respect, it would seem that warmer winters will only add to the conundrum in the future, promoting rather than suppressing virus survival and vector longevity. Vaccination still seems to be the best defence available to us, but have we waited too long?

The underlying factors for the fast expanding nature of the 2007 BT episode merit further investigations. Still, following hypotheses can be suggested:

- A considerable virus reservoir was present in the host populations at the onset of the epidemic
- More _Culicoides_ have been captured in a cooler and wetter 2007
- A relative change in some vector _Culicoides_ abundances

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8. REFERENCES


