

## Bluetongue virus in South America: overview of viruses, vectors, surveillance and unique features

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### Summary

Since the first published report of bluetongue (BT) virus (BTV) infection in South America from Brazil in 1978, serological surveys have determined that the infection is widespread in sheep, cattle, goats and water buffalo but generally without clinical signs. Only four outbreaks of BT disease have been reported so far in Brazil. Brazil and Argentina are the only countries in South America where BTV serotypes 12 and 4 have been isolated, respectively. By serology, serotypes 4, 6, 14, 17, 19 and 20 were detected in Brazil, 12, 14 and 17 in Colombia, 14 and 17 in Guyana and 6, 14 and 17 in Suriname. *Culicoides insignis* is the predominant vector in the area, but *C. pusillus* could also be a BTV vector. The virus has not yet been isolated from the vector in the region.

### Keywords

Bluetongue – *Culicoides* – Serotypes – South America – Virus.

### Distribution of bluetongue virus infection in South America

The global distribution of bluetongue (BT) virus (BTV) historically has been shown to be between latitudes of approximately 40°N and 35°S (25). Eleven of the thirteen South American countries have their territory entirely in that area. As in other parts of the world, the livestock population in all these countries lying in the tropics and subtropics are considered BTV-infected (10). Parts of Chile and Argentina are south of that area. Chile detected seropositive bovines and ovines in 1985 (30), but recent information indicates that BTV infection is not present (33). In Argentina two serological surveys were conducted to determine the distribution of the BTV infection. Climatic factors, such as temperature and precipitation, were considered for the sampling design. In the first survey, 4 874 bovine serum samples from 602 farms corresponding to six north-east provinces (Chaco, Formosa, Santa Fé, Entre Ríos, Corrientes and Misiones) were analysed between 1995 and 1996. The results indicated that Formosa, Santa Fé and Entre Ríos were seronegative while Misiones had 539 positive samples from a total of 1 325 and the Departments of Santo Tomé and Ituzaingo of Corrientes revealed that 11 bovines possessed

antibodies from a total of 1 528. In 1998, a second serological survey was performed, examining 1 499 bovine and 746 ovine samples from Chaco, Formosa, Santa Fé, Entre Ríos, Corrientes and Misiones. Again, only the Misiones Province had a prevalence of antibodies of 125/248 in bovines and 19/20 in ovines, and the same Departments of Corrientes Province had 8/295 in bovines and 13/405 in ovines. Similar data was obtained in Brazil where it was found that in the Rio Grande do Sul State there were few positive animals compared with Paraná, Santa Catarina and Sao Pablo States (6). Uruguay, which is close to the seronegative area of Argentina, also considers its territory free of BTV infection. These factors suggest that the southern extent of BTV infection in South America could be further north than the parallel 35°S or that the distribution of the infection has a particular pattern like that in Australia. For this reason, it is important to improve the surveillance and monitoring work in the region.

### Susceptible species infected and seroprevalence

The first published report of BTV infection in South America was from Brazil in 1978 (5). Serological evidence of infection was detected in livestock in the

States of Sao Paulo and Rio de Janeiro (21). Since then, several serological surveys have determined that the infection is widespread in South America but generally without overt disease (1, 2, 5, 6, 7, 8, 9, 10, 11, 15, 16, 17, 19, 21, 22, 23, 29, 30). In most of these serological surveys the agar gel immuno-diffusion (AGID) technique was used. It is very likely that some BTV-seropositive animals were actually infected with related orbiviruses, such as

epizootic haemorrhagic disease virus, since the BTV antigen is group-specific and cross-reactions are common with AGID. The domestic species involved in these surveys were bovines (2, 5, 6, 7, 10, 11, 13, 15, 16, 17, 21, 22, 30, 32), ovines (5, 8, 11, 15, 29), water buffalo (19, 32) and caprines (1, 5, 8, 9, 11). The percentages of antibody prevalence of these surveys showed a wide range even in the same country (Table I).

**Table I**  
**Bluetongue virus serological surveys in countries of South America**

| Country   | Location           | No. of samples/species/<br>technique | Seroprevalence (%) | Ref. |
|-----------|--------------------|--------------------------------------|--------------------|------|
| Argentina | Misiones           | 1 325 / bov / AGID                   | 40.7               | *    |
|           |                    | 248 / bov / AGID                     | 35.88              | **   |
|           |                    | 20 / ov / AGID                       | 95                 | **   |
|           | Corrientes         | 1528 / bov / AGID                    | 0.7                | *    |
|           |                    | 295 / bov / AGID                     | 2.7                | **   |
|           |                    | 415 / ov / AGID                      | 3.13               | **   |
|           |                    | 93 / bov / c-ELISA                   | 21.50              | (13) |
|           | Chaco, Formosa     | 2 021 / bov / AGID                   | 0                  | *    |
|           | Entre Ríos         | 956 / bov / AGID                     | 0                  | **   |
|           | Santa Fé           | 311 / ov / AGID                      | 0                  | **   |
| Brazil    | Paraíba            | 137 / bov / AGID                     | 4.82               | (22) |
|           | Sergipe            | 97 / bov / AGID                      | 89.69              | (23) |
|           | Mina Gerais        | 410 / bov / AGID                     | 76.3               | (2)  |
|           |                    | 340 / cap / AGID                     | 5.9                | (9)  |
|           |                    | 329 / buf / AGID                     | 54.4               | (19) |
|           | Rio de Janeiro     | 553 / bov / AGID                     | 40.86              | (7)  |
|           |                    | 626 / cap / AGID                     | 44.08              | (8)  |
|           |                    | 66 / ov / AGID                       | 24.24              | (8)  |
|           | Sao Pablo          | 214 / bov / AGID                     | 53.73              | (6)  |
|           | Paraná             | 106 / bov / AGID                     | 19.81              | (6)  |
|           | Sta Catarina       | 174 / bov / AGID                     | 37.75              | (6)  |
|           | Rio Grande do Sul  | 409 / bov / AGID                     | 1.22               | (6)  |
| Chile     | X Region           | 1752 / bov / AGID                    | 19.6               | (30) |
|           |                    | 434 / bov / NS                       | 0                  | (35) |
|           | NS                 | 1 139 / bov / NS                     | 0                  | (35) |
|           |                    | 1 224 / ov / NS                      | 0                  | (35) |
| Colombia  | Antioquia, Cordoba | 635 / bov / AGID                     | 51.8               | (16) |
|           | Valle de Aburra    | 86 / bov / AGID                      | 56                 | (17) |
| Ecuador   | El Oro             | 87 / bov / AGID                      | 10                 | (21) |
| Guyana    | Diverse areas      | 719 / bov / AGID                     | 56                 | (11) |
|           |                    | 387 / bov / AGID                     | 50                 | (11) |
|           |                    | 255 / cap / AGID                     | 40                 | (11) |
|           | Rupununi           | 50 / bov / AGID                      | 8                  | (11) |
|           |                    | 25 / ov / AGID                       | 0                  | (11) |
|           |                    | 25 / cap / AGID                      | 4                  | (11) |
| Peru      | North              | 8 / ov / AGID                        | 87.5               | (29) |
|           | Central            | 17 / ov / AGID                       | 41                 | (29) |
|           | South              | 9 / ov / AGID                        | 55.5               | (29) |
| Suriname  | Diverse areas      | 451 / bov / AGID                     | 82                 | (11) |
|           |                    | 77 / ov / AGID                       | 88                 | (11) |
|           |                    | 68 / cap / AGID                      | 91                 | (11) |
| Venezuela | Aragua             | 151 / bov / AGID                     | 74.8               | (10) |
|           |                    | 151 / bov / c-ELISA                  | 94.7               | (10) |

\* 1995-1996 survey (data not published)

\*\* 1998 survey (data not published)

NS not specified

This could be due to differences in climatic and environmental factors that affect the distribution of the vector/s and/or the susceptible host (6, 11, 12). The prevalence of antibodies is not consistently high in any one species or country. Most of these data were obtained in the 1980s, and in some countries they are the only available data so they must be only considered as indicative. There have been changes in climatic factors and in land use affecting the geographical distribution of ruminants that could have modified those values. Other species have been analysed for the presence of antibodies as possible hosts or reservoirs. In Argentina, free-ranging llamas, guanacos, vicuñas and Pampean deer were negative (18, 20, 26, 35) but Peru found that alpaca could be infected (27). In 1991, cervids in the Rio de Janeiro Zoo were affected by a haemorrhagic disease and, in January-February 1992, the disease was described in a herd of brown brocket (*Mazama gouazoubira*) on the campus of the University of São Paulo State (UNESP), Brazil. One of four brockets died. Again in this institution, six brown brockets died in 1993. Serological studies by AGID indicated antibodies against BTV or a related orbivirus (4). In July 1992, the disease was documented in one specimen from a marsh deer (*Blastocerus dichotomus*) in the Ilha Solteira Zoo in Brazil (4).

## Clinical disease

Only four outbreaks of BT have been reported to date in South America, all of which occurred in the last three years in Paraná State, Brazil. The first was in April 2001, on a mixed farm in the area of Curitiba (Table II). The affected animals were eight sheep and one goat that had severe and acute disease. The clinical signs in the sheep included temperature, depression, hyperaemia of the oral cavity, facial oedema especially on the lips, tongue, muzzle and submandibular space.

**Table II**  
One outbreak of bluetongue 04/2001, Paraná, Brazil

| Species | Number of animals |       |        |
|---------|-------------------|-------|--------|
|         | Susceptible       | Cases | Deaths |
| Bovine  | 70                | 0     | 0      |
| Caprine | 4                 | 1     | 1      |
| Ovine   | 130               | 8     | 3      |

Source: OIE, Handistatus II

Necrosis of the epithelium of the nose and tongue, hyperaemia and petechial haemorrhages of the pharynx, oesophagus, ruminal and omasal mucosa were also present (3). In February 2002, the second outbreak in goats took place and the last two

occurred in March 2002 affecting sheep and goats (Tables III and IV). These recent outbreaks might suggest changes in the virulence of the local serotypes/strains of BTV, introduction of new serotypes or strains, movement of susceptible animals due to livestock trade, or factors that favour proliferation of the vector/s.

**Table III**  
One outbreak of bluetongue 02/2002, Paraná, Brazil

| Species | Number of animals |       |        |
|---------|-------------------|-------|--------|
|         | Susceptible       | Cases | Deaths |
| Caprine | 70                | ...   | 13     |

Source: OIE, Handistatus II

**Table IV**  
Two outbreaks of bluetongue 03/2002, Paraná, Brazil

| Species | Number of animals |       |        |
|---------|-------------------|-------|--------|
|         | Susceptible       | Cases | Deaths |
| Caprine | 84                | 29    | 18     |
| Ovine   | 82                | 13    | 9      |

Source: OIE, Handistatus II

## Bluetongue virus isolation

The first BTV isolation from naturally infected animals in South America was serotype 4 from Zebu cattle that were imported from Brazil to the USA (14). Brazil and Argentina are the only countries in South America where BTV has been isolated. Isolation of the virus in Brazil was made by Panaflosa from blood and tissue samples of clinically affected sheep and goats during the April 2001 outbreak, and was confirmed by reverse transcriptase-polymerase chain reaction (RT-PCR) and typed as serotype 12 by virus neutralisation (VN) (3). In Argentina, BTV was isolated at the National Institute of Agricultural Technology (INTA)-Castelar from the blood of sentinel cattle without clinical signs and serotyping was confirmed by the Institute for Animal Health in Pirbright, as type 4 by VN and RT-PCR with primers corresponding to segment 2 of the BTV genome (13, 34).

## Detection of serotypes by serology

Using serological techniques, the serotypes that may be present in South America are: 4, 6, 14, 17, 19 and 20 in Brazil (5, 14); 12, 14 and 17 in Colombia (17); 14 and 17 in Guyana and 6, 14 and 17 in Suriname (15). These results should be considered as preliminary because of the serological cross-reactions among BTV serotypes. No other reports are available from the other countries in the region, indicating that information on the serotypes present in South America is very limited and not recent.

## Vectors

Very little information is available about the vector/s involved in the transmission of BTV in South America. *C. insignis* is possibly the predominant vector in the area (6, 13, 17, 28). BTV has been isolated from *C. insignis* in Central America and the Caribbean (24) and also has been shown capable of the transmission of BTV in southern Florida (31). However, as BTV was isolated from *C. pusillus* in Central America and the Caribbean and this species is also present in South America, it is possible that *C. pusillus* could be a BTV vector in the area (24, 28). The information available in South America is insufficient to exclude the possibility that additional species of *Culicoides* may also transmit BTV. The virus has not yet been isolated from the potential vectors in the region.

## Present and future studies

Argentina is conducting an epidemiological surveillance programme for BTV. This programme is conducted by a BTV working team of professionals from SENASA (National Animal Health Service) and the BTV Argentina working team SENASA-INTA, namely: S. Duffy, J. Miquet, A. Vagnozzi, C. Gorchs, G. Draghi, B. Cetrá, C. Soni, V. Ramirez, N. Pacienza and M. Ronderos. A sentinel animal monitoring project was conducted from 1999 to 2001 in the Santo Tomé and Ituzaingó Departments of the Corrientes Province. The conclusions were that though clinical disease has never been reported in Argentina, viral activity was present and the BTV strain isolated was serotype 4. In addition, a marked variability in the cumulative incidence of BTV infection among herds and between years was detected, with absence of BTV activity from May to September. *C. insignis* was the predominant potential vector species detected. A new project has started and, as was the case previously, it is supported by SECYT (Science and Technology Secretary). This investigation will provide information on the incidence of BTV infection in sheep and cattle, the seasonal incidence of the virus and vector/s, the serotypes of the BTV isolated and the *Culicoides* species that can potentially serve as vectors in BTV-infected regions of Argentina. The introduction of positive animals in the areas free of infection will be monitored to determine if they can be a source of infection for the native animals and for how long they remain seropositive. Therefore, although there is work to be done, awareness of the problem is increasing and measures are being taken to improve the knowledge of the epidemiological situation of BTV infection in South America.

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