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Identification of bluetongue virus and epizootic hemorrhagic disease virus serotypes in French Guiana in 2011 and 2012

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ABSTRACT

In French Guiana, the sero- and viro-prevalence of Bluetongue virus (BTV) is high but the circulating serotypes remain unknown. No data are available regarding the prevalence of Epizootic hemorrhagic disease (EHD). This study was conducted to assess the prevalence and to identify the circulating serotypes of these two Orbiviruses in this region (BTV and EHDV). Blood samples were collected in main livestock areas, from 122 young cattle between June and August 2011, to perform virological (PCR and viral isolation) and serological (ELISA) analyses. Moreover, samples from sheep and goat showing BTV-like clinical signs and from newly imported animals were analyzed using the same assays. Results confirmed an important viral circulation, with viro- and seroprevalence of 85% and 84% and 60% and 40% for BTV and EHDV, respectively. Ten Orbivirus serotypes were identified (BTV-1, 2, 6, 10, 12, 13, 17 and 24, EHDV-1 and 6). The circulation of many serotypes in intertropical America and in the Caribbean region underlines the need to establish measures to monitor and control animal movements.

Bluetongue virus (BTV) and epizootic hemorrhagic disease virus (EHDV) belong to the *Reoviridae* family and the *Orbivirus* genus (MacLachlan and Osburn, 2004; Verwoerd and Erasmus, 2004). These two viruses have structural, antigenic and molecular similarities. Both viruses are transmitted to their host range (ruminants) by *Culicoides* biting midges. Serological and molecular techniques for the laboratory diagnosis of these two diseases are similar.

Both viruses have seven different structural proteins (VP1 to VP7) divided into two capsids (Roy, 2005). The outer capsid consists of VP2 and VP5, while VP7 and VP3 form the inner capsid that contain the viral genome and the replication complex (VP1, VP4 and VP6). VP2, the major constituent of the outer capsid, is exposed at the surface of the virus particle and determines the serotype specific antigen. Twenty-six BTV serotypes (Maan et al., 2011) and 7 EHDV serotypes have been identified (Anthony et al., 2009). The specific antigens of each serotype induce the production of serotype-specific neutralizing antibodies. Segment 2, which encodes VP2, is favored to study the genetic variability between different serotypes.

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Five BTV serotypes have long been identified in North America, specifically BTV-10, 11, 13 and 17, whereas BTV-2 was restricted to the south-eastern USA until 2010 when this serotype infected California (MacLachlan et al., 2013). Since 1998, 10 additional serotypes (BTV-1, 3, 5, 6, 9, 12, 14, 19, 22, 24), that were previously identified as exotic, have been isolated in the south-eastern USA but were not associated to disease outbreaks (MacLachlan and Guthrie, 2010). In the 1980s, a major program of sentinel herds has shown that BTV-1, 3, 4, 6, 8, 12, 17 were circulating in Central America and the Caribbean region, presumably without clinical expression (Mo et al., 1994). In South America, the only serotypes detected by virological methods (virus isolation or genome detection by Polymerase Chain Reaction) were serotype 4 in Brazil in 1979 and more recently in Argentina (Lager et al., 2004; Legisa et al., 2013) and serotype 12 in the southern provinces of Brazil in two clinical episodes in 2001 (Clavijo et al., 2002).

In the Caribbean islands of Martinique and Guadeloupe, BTV-1, 2, 3, 5, 9, 10, 11, 13, 14, 17, 18, 22 and 24 were detected by RT-PCR between 2006 and 2011, in sheep with clinical signs, as well as in newly imported cattle from continental France used as sentinel animals (MacLachlan et al., 2007; Sailleau, unpublished data).

Little information is available about the circulation of EHDV in South America. A study conducted in the 1980s identified antibodies against EHDV-1 and -2 (Gumm et al., 1984). In the USA, two serotypes, EHDV-1 (New Jersey strain) and EHDV-2 (Alberta strain), are endemic (Chalmers et al., 1964) (Shope et al., 1955). Moreover, in 2006, an exotic strain of EHDV-6 was isolated from moribund and dead white-tailed deer (*Odocoileus virginianus*) in Indiana and Illinois, that originates from a reassortment between serotypes 2 and 6 co-circulating strains (Allison et al., 2010).

In the Caribbean region, EHDV-2 and 6 were detected by RT-PCR in 2010 and 2011 in Martinique and Guadeloupe (Viarouge, unpublished data).

In 2011, to assess the animal-health risks associated with livestock trade with Martinique and Guadeloupe, the French Guiana directorate of veterinary services launched a survey to determine which serotypes of BTV and EHDV were circulating on their territory, with respect to those found in the Caribbean districts. We report here the results of this survey conducted in local and imported cattle and in small ruminants.

1. Materials and methods

1.1. Study area

Guiana is a South-American French district (83,846 km^2), spanning between latitude 2° and 6°N, mostly covered (96%) by the rain forest (Fig. 1). It benefits

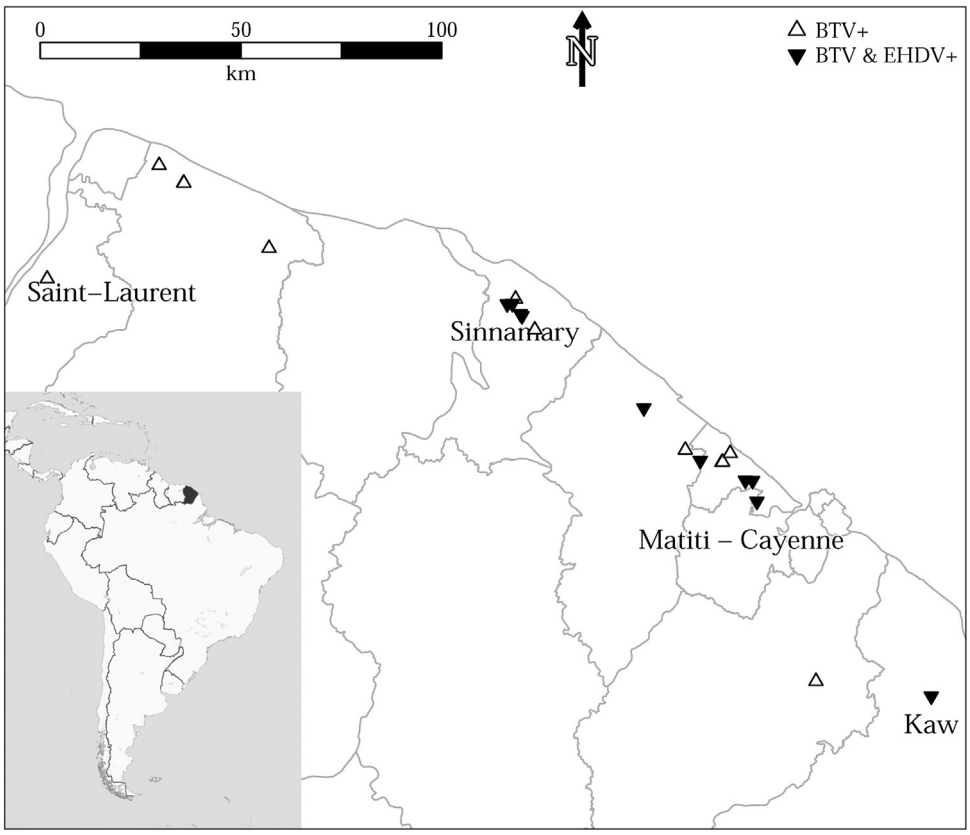

Fig. 1. Geographical location of animals sampled in French Guiana in 2011 and 2012 (for imported sheep) and distribution of animals testing positive with RT-PCR.