Seroprevalence of bluetongue virus infection in goats in the central China

Luo, H.Q.1,2*, Li, K.2†, Zhang, H.2, Lan, Y.F.3, Peng, J.P.3, Shahzad, M.4 and Wang, J.X.5*

1College of Animal Sciences, Wenzhou Vocational College of Science and Technology, Wenzhou 325006, People's Republic of China
2College of Veterinary Medicine, Huazhong Agricultural University, Wuhan 430070, People's Republic of China
3China Agricultural University, College of Veterinary Medicine, Beijing 100083, People's Republic of China
4University College of Veterinary & Animal Sciences, The Islamia University of Bahawalpur, 63100 Pakistan
5College of Animal Science, Yangtze University, Jingzhou 434023, People's Republic of China

†Those two authors contributed equally to this study.
*Corresponding author e-mail: chviolet1984@sina.com (H. Lou); wangjiaxiang1109@163.com (J. Wang)

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Abstract. Seroprevalence of Bluetongue virus (BTV) in goats from Hubei was investigated by a commercial competitive enzyme-linked immunosorbent assay kits. Blood samples (n=1157) were collected during the year 2014 and 2015. The results showed that 13.31% (CI 95%: 11.4%–15.4%) serum samples were positive for BTV antibodies in goats in Hubei. The prevalence of BTV antibodies in each region ranged from 1.32% to 27.70%, and differences among the regions were statistically significant (p < 0.01). The prevalence of BTV in male and female goats was 14.23% (95% CI: 11.3, 17.6) and 12.58% (95% CI: 10.1, 15.4), respectively, no significant difference in genders (p > 0.05). In different seasons, the seroprevalence were 8.94% (95% CI: 5.6, 13.3) in spring; 18.31% (95% CI: 14.5, 22.7) in summer; 23.08% (95% CI: 17.0, 30.2) in autumn and 6.98% (95% CI: 4.6, 10.0) in winter, respectively with a significant difference of the prevalence in the different seasons (p < 0.01).

INTRODUCTION

Bluetongue Virus (BTV), a member of the genus Orbivirus and family Reoviridae (Arun et al., 2014; Li et al., 2015a), which causes of an infectious disease of ruminants, bluetongue (BT) (Katsoulos et al., 2016), Office International Epizooties (OIE) listed arthropod-borne viral disease (Mozaffari et al., 2014). BTV is transmitted between the vertebrate hosts by Culicoides spp (Arun et al., 2014). BT was first discovered in Africa in the early 19th century and can infect all wild and domestic ruminant species (Toye et al., 2013; Li et al., 2015a). BTV may cause a hemorrhagic disease with high morbidity rates, especially in sheep (Casaubon et al., 2013), Ban on the export of animals or animal products from BTV infection regions (Seo et al., 2015), causes a severe economic losses.

In China, goat milk and meat are important economic resources, so any disease threat to the goat results into the significant economic losses in goat production. However, until now scarce information is available about the prevalence of BTV infection in goats in Hubei province having abundant agricultural resources including 4.70 million (National Bureau of Statistics of China; http://data.stats.gov.cn/easyquery.htm?cn=E0103) goats in the central China. Therefore, the objective of the present research was to estimate the seroprevalence of BTV based on VP7 antibodies in goats in Hubei province for the
first time. VP7 consists of the core surface layer of the protein bilayer of the transcriptionally active BTV core (Grimes et al., 1998). As this protein is more highly conserved than the components of the outer capsid, and show serological cross reactions between any BTV strains, VP7 in particular is a highly immunodominant antigen, which is detected in the majority of BTV serogroup-specific serological assays (Anthony et al., 2007).

MATERIALS AND METHODS

Samples Collection: Blood samples from the caudal vein were collected by local veterinary practitioners from 1157 goats in 2014 and 2015 in 6 counties in Hubei province (Table 1). After collection, samples were centrifuged at 1000 × g for 10 min, and serum was separated and stored at -20 °C till further analysis.

Determination of BTV antibodies: Serum samples were tested by a commercial competitive enzyme linked immunosorbent assay (ELISA) (BTV VP7 Antibody Test Kit, IDEXX) according to the manufacturer’s instructions. The S/N (%) value was calculated based on the optical density (OD) values according to the formula: S/N (%) = OD 450 of samples / average OD 450 of negative controls times 100%. To ensure validity, the average OD 450 of negative controls was ≤ 3.000 and ≥ 0.700; the S/N (%) value of positive was < 20%. The results were interpreted as: negative when the S/N (%) ≥ 80%; suspicious and tested again when the S/N (%) value was between 70% & 80%; and positive when S/N (%) value ≤ 70%.

Statistical analysis: Statistical analysis was performed by chi-square test with SPSS (Statistical Analysis System, Version 17.0). The differences were considered statistically significant when P < 0.05.

RESULTS

The results showed a total prevalence of BTV was 13.31% (95% CI: 11.4, 15.4). The regional seroprevalence of BTV antibodies was 100% (6/6). Antibodies against BTV in each region ranged from 1.32% to 27.70%, and differences among the regions were statistically significant (p < 0.01).

The prevalence in male and female goats was 14.23% (95% CI: 11.3, 17.6) and 12.58% (95% CI: 10.1, 15.4), respectively, and there were no significant difference in different genders (p ≥ 0.05). In different seasons, the seroprevalence was 8.94% (95% CI: 5.6, 13.3) in spring; 18.31% (95% CI: 14.5, 22.7) in summer; 23.08% (95% CI: 17.0, 30.2) in autumn and 6.98% (95% CI: 4.6, 10.0) in winter, respectively with a significant difference of the prevalence in the different seasons (p < 0.01) (Table 1).

DISCUSSION

BT is an infectious disease of ruminants (Vangeel et al., 2012; Li et al., 2015a). Previously, BTV infection had been reported in many countries and areas. In the current study, the prevalence of BTV antibodies (13.31%) was higher than the seroprevalence of BTV infection in cattle in Kenya (0.942%) (Toye et al., 2013) and Northern Kerala, India (6.9%) (Arun et al., 2014), Madagascar (0.62%) (Andriam & Dimby et al., 2015); and yaks (4.89%) in Tibet, China (Li et al., 2015a). In our study the prevalence was lower than the prevalence BTV infection in goats in southeast Iran (67.7%) (Mozaffari et al., 2014). The difference may because of different detection methods employed, difference in geography, environment, climate (Li et al., 2015b) and the distribution of Culicoides midges (Katsoulos et al., 2016).

In China, the first report of BTV was in 1979 in Yunnan province, and since then, many provinces have reported disease and antibodies (Li et al., 2015). In a study conducted in 1996, four ruminant species were found susceptible to BTV with the presence of vector species of Culicoides in China (Li et al., 1996). In the current research, the prevalence of BTV among the regions statistically significant (p < 0.01). There were no significant difference with genders (p ≥ 0.05). The results indicate that the two genders may have equal opportunity of
Table 1. The seroprevalence of Bluetongue in goats in different counties, genders and seasons in Hubei province, China

<table>
<thead>
<tr>
<th>County</th>
<th>Samples</th>
<th>Positive</th>
<th>Prevalence (%)</th>
<th>Confidence interval (95%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wuhan</td>
<td>191</td>
<td>21</td>
<td>10.99</td>
<td>6.9–16.3</td>
</tr>
<tr>
<td>Huangshi</td>
<td>250</td>
<td>36</td>
<td>14.40</td>
<td>10.3–19.4</td>
</tr>
<tr>
<td>Xiangyang</td>
<td>228</td>
<td>3</td>
<td>1.32</td>
<td>0.3–3.8</td>
</tr>
<tr>
<td>Suizhou</td>
<td>213</td>
<td>59</td>
<td>27.70</td>
<td>21.8–34.2</td>
</tr>
<tr>
<td>Yichang</td>
<td>161</td>
<td>15</td>
<td>9.32</td>
<td>5.3–14.9</td>
</tr>
<tr>
<td>Jingzhou</td>
<td>114</td>
<td>20</td>
<td>17.54</td>
<td>11.1–25.8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gender</th>
<th>Samples</th>
<th>Positive</th>
<th>Prevalence (%)</th>
<th>Confidence interval (95%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>513</td>
<td>73</td>
<td>14.23</td>
<td>11.3–17.6</td>
</tr>
<tr>
<td>Female</td>
<td>644</td>
<td>81</td>
<td>12.58</td>
<td>10.1–15.4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Season</th>
<th>Samples</th>
<th>Positive</th>
<th>Prevalence (%)</th>
<th>Confidence interval (95%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring</td>
<td>235</td>
<td>21</td>
<td>8.94</td>
<td>5.6–13.3</td>
</tr>
<tr>
<td>Summer</td>
<td>366</td>
<td>67</td>
<td>18.31</td>
<td>14.5–22.7</td>
</tr>
<tr>
<td>Autumn</td>
<td>169</td>
<td>39</td>
<td>23.08</td>
<td>17.0–30.2</td>
</tr>
<tr>
<td>Winter</td>
<td>387</td>
<td>27</td>
<td>6.98</td>
<td>4.6–10.0</td>
</tr>
</tbody>
</table>

| Total  | 3471    | 462      | 13.31          | 12.2–14.5                |

*There were significant difference in the prevalence of BTV in different counties (p < 0.01, χ² = 71.790).
*bThere were significant difference in the prevalence of BTV in different counties (p < 0.01, χ² = 39.238).

infection this virus. The seasonal differences in prevalence of BTV antibodies may be because of the increasing activities of Culicoides in summer and autumn.

BTV is transmitted between ruminant hosts almost exclusively through the bites of the females of vector species of the Culicoides spp. biting midge (Khezri et al., 2013). The infected goats may have a potential threat to other animals by transmitting this pathogen through midges, as in most areas of Hubei province have subtropical monsoon climates, plentiful rainfall, with a mean annual temperature of 15-17ºC.

In conclusion, the prevalence of BTV infections in goats is reported for the first time in Hubei province, in the central China. Considering the enormous economic losses, measures should be implemented to prevent the spread of BTV and zero the potential threats of BTV in animals in this agroecologically and geopolitically important region of China.

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Conflict of interest
The authors declare that they have no competing interests.

REFERENCES


