

## SCIENTIFIC ASSESSMENT ON DETERMINATION OF THE MOST APPROPRIATE PERIOD FOR PERFORMANCE OF TOTAL VACCINATION OF RUMINANTS AGAINST BLUETONGUE DISEASE ON THE TERRITORY OF THE REPUBLIC OF BULGARIA IN 2021

Iliyan Kostov, Georgi Georgiev, Madlen Vasileva

*Risk Assessment Canter on the Food Chain at the Ministry of Agriculture, Food and Forestry,  
Sofia, Bulgaria*

*E-mail: irkostov@mzh.government.bg*

### ABSTRACT

Bluetongue (BT) is an acute, viral, vector-borne, non-contagious disease of ruminants caused by the Bluetongue virus (BTV). It is transmitted by insects of the genus *Culicoides*. It is characterized by some strong seasonal dynamics in the countries of temperate latitudes mid-latitude climates, associated with the period of active flight of vectors. With this study we set a goal to make a scientific assessment of the appropriate period for general vaccination against bluetongue in ruminants in the territory of the Republic of Bulgaria in 2021. Taking into account the life cycle of the vectors, the temperatures at which they begin to become active and the time to build active immunity in cattle and sheep, we recommend that vaccination in 2021 may begin in the first half of February 2021 at the earliest. It is more likely for Southern Bulgaria to start in the first half of March, and for Northern Bulgaria – in the second half of March 2021.

**Key words:** blue tongue, vectors, vaccination, suitable climatic conditions.

### Introduction

Bluetongue (BT) is an acute, non-contagious, viral, vector-borne disease in ruminants caused by the Bluetongue virus (BTV). It is transmitted by insects of the genus *Culicoides*. The seasonal dynamics is associated, especially in the countries of temperate latitudes, with the period of active flight of the vectors.

The virus belongs to the genus *Orbivirus* of the family *Reoviridae*. The bluetongue virus is characterized by high antigenic variability of 270 serological types, which is determined by the plasticity and segmentation of its genome. It can infect a wide range of domestic and wild ruminants – sheep, goats, antelopes, cattle, buffalo, deer, roe deer, llama, alpaca and others, and therefore the disease is also referred to as bluetongue in ruminant. The cattle and goats usually develop subclinical infections and can therefore serve as important and hidden viral reservoirs for sheep. Prior to 1998, BT was considered an exotic disease in Europe. Since 1998 till 2005, at least 6 strains of BT virus belonging to 5 serotypes (BTV-1, BTV-2, BTV-4, BTV-9 and BTV-16) were continuously present in the Mediterranean basin. Since August 2006, the BTV-8 has caused a severe BT epizootic in Northern Europe.

Thus, in the period 1999 – 2001, two BT epizootics caused by BTV serotype 9 were realized in Bulgaria. In the summer of 1999, the „exotic” bluetongue disease was registered in Bulgaria for the first time. In the summer of 2014, after the first cases of BTV-4 in Bulgaria, the Bulgarian Food Safety Agency (BFSA) conducted in 2015 an emergency vaccination of the entire population of large and small ruminants under a program approved by the European commission. A vaccine "BTVPUR AISap4-BG" was used. According to information received from the BFSA, in 2021 BLUEVAC 4BG vaccine (a suspension for injection) will be used during the vaccination campaign for sheep and cattle. With this study we set the goal to make a scientific assessment of determining

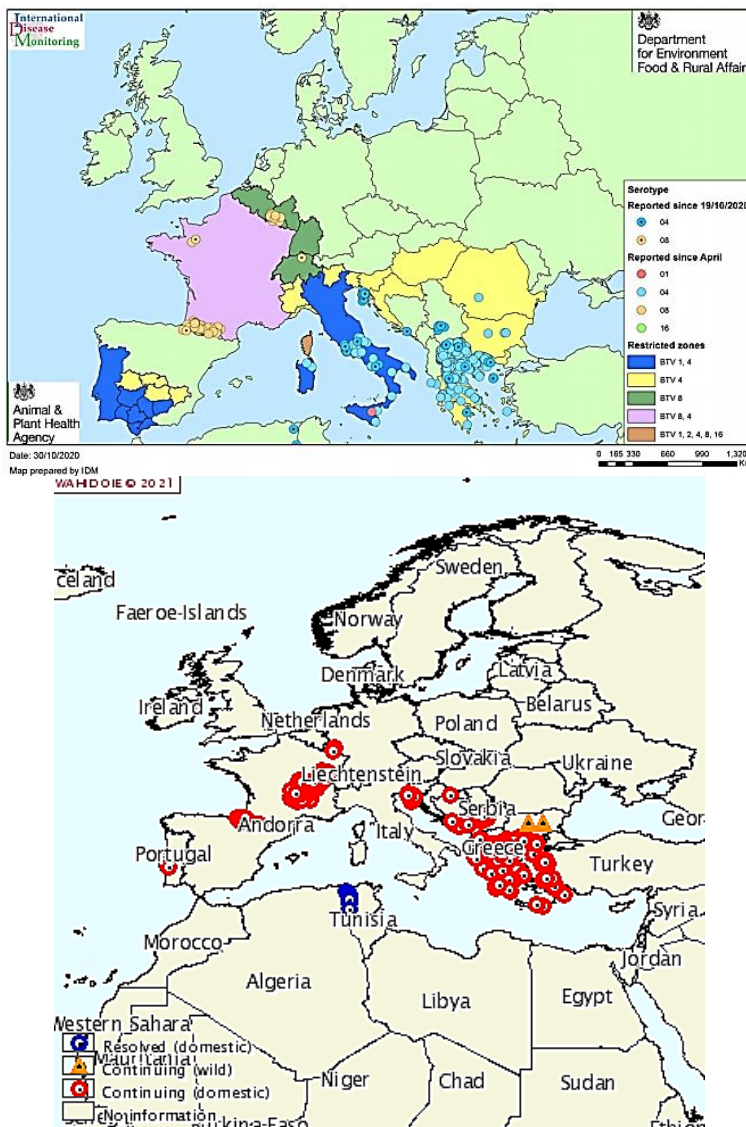
the most appropriate period for vaccination against bluetongue in ruminants in the territory of the Republic of Bulgaria in 2021.

**Materials and methods**

For the preparation of the assessment, comparative methods have been used. They describe the interaction of risk factors that play a role in determining the most appropriate period for the vaccination of ruminants based on the epidemiological situation in the world and Europe with regard to bluetongue and assessment of the most appropriate period for vaccination against bluetongue in ruminants on the territory of Bulgaria in 2021.

**Results**

**BT epidemiological situation in the world and Europe (byDEFRA)**



Data from the European Union's Animal Disease Reporting System (ADNS) show that in 2020 (01.01 – 31.01.2020) there were in total 1042 BT outbreaks in Europe, affecting 15 countries. All 12 cases of bluetongue BTV-4 in Bulgaria reported in 2020 are in wild ruminants as follows:

**October 2020:** two cases of roe deer (*Capreolus capreolus*) in Sliven region, and one of red deer found dead in Lovech region. These are the first cases in Bulgaria since 2014. All three cases were confirmed after positive PCR testing at the National Reference Laboratory in Bulgaria.

**November 2020:** 3 red deer (*Cervus elaphus*) – two in Lovech region and one in Vidin region; 2 deer (*Capreolus capreolus*) in Vratsa region; 4 fallow deer (*Dama dama*).

In Europe, in 2021, in the period 01.01.2021 – 08.01.2021, outbreaks of bluetongue were reported from Italy, Albania, Montenegro, Bosnia and Herzegovina, Northern Macedonia and Serbia.

Bulgaria reported to OIE on 4.01.2021 about two cases of bluetongue in wild ruminants in Blagoevgrad region – 1 fallow deer (*Dama dama*) and one mouflon (*Ovis orientalis*).

### **Assessment of the most appropriate BT vaccination period for the ruminants in Bulgaria in 2021**

In assessing the appropriate time period for vaccination against bluetongue in ruminants in Bulgaria in 2021, the following factors were taken into account:

1. Vectors and transmission of Bluetongue;
2. Monthly average climate data for Bulgaria and seasonal forecast for Bulgaria for the seasons winter 2020/21 and spring 2021;
3. Type of vaccine used, immunity building and organization of vaccination against bluetongue of ruminants.

#### **1. Vectors and BT transmission**

The main source of infection is virus-infected ruminants in viremia stage, and the virus is transmitted between ruminant hosts exclusively through the bites and blood-sucking of vector species (females) of the genus *Culicoides*. In sheep and goats, the viremia continues about 48-50 days after infection, and in cattle – up to 100 days or more. The duration of the viremic period and the short winters, when the activity of *Culicoides* decreases or ceases, explain the endemicity of the disease in the subtropics and some countries in North Africa and the Central Mediterranean. In the Central and Western Mediterranean region, there are areas where climatic and geographical conditions allow the overwintering of bluetongue virus, and so some *Culicoides* species, transmitting the disease, remain active throughout the year. All data on the spread of the virus in Northern Macedonia, Greece and Southern Italy show that BTV-4, after the epizootic 2014 – 2016, continues to circulate in certain regions of Europe and through the vectors *C. pulicaris* and *C. Obsoletus* overwinters and persists in between epidemic periods and spreading to new territories. **Today it is already known that an absolute vector-free period may not exist in some regions of Europe** – the southern parts of Europe, Spain, Portugal, Italy and Greece, as well as in North Africa. Of particular importance for Bulgaria are the Central Mediterranean, the Greek islands and the countries of the Western Balkans (Croatia, Montenegro, Albania), with mild Adriatic climate.

The spread of *Culicoides punctatus*, *Culicoides obsoletus* и *Culicoides pulicaris*<sup>1</sup> is given on the following maps:

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<sup>1</sup>Biting midge maps; Vector Net by EFSA and ECDC; <https://www.ecdc.europa.eu/en/disease-vectors/surveillance-and-disease-data/biting-midge-maps>



show that in Bulgaria the culicoids perform annually from 5 to 6 biological cycles. From 33 culicoids' species registered on the territory of Bulgaria two main groups of competent bluetongue vectors (*Culicoides Obsoletus* and *Culicoides Pulicaris*) have been identified. Their highest seasonal activity occurs in early June, followed by a second peak in August and a third peak in early October. They are most active at average daily temperatures above 12.50° C and their competence increases in the range of 25 – 30° C. These temperatures are associated with the additional multiplication of the bluetongue virus in the salivary glands of culicoids. **At temperatures below 10° C in autumn, the activity of culicoids decreases and gradually ceases during the winter season. Therefore, bluetongue in areas with temperate continental climates have a distinctive seasonal nature, which coincides with summer.** Observations on the seasonal dynamics of culicoids in Bulgaria show that for the southern parts of the country, the first peak of high activity was observed most often at the end of June and it coincides with the first cases of bluetongue in the country (epizootics from 1999 and 2014).

The literature shows that it takes at least 40 days from the onset of the first infected culicoids to reach sufficient population density and high numbers of bites in order to achieve the necessary vector capacity to maintain the epizootic process of bluetongue.

An immediate threat of cross-border transmission of the virus exists from areas where there are conditions for overwintering the virus, vaccinations are not carried out or from where it is currently circulating. It should also be emphasized that the presence of **non-immune wildlife populations** that are not covered by immunoprophylactic measures creates the preconditions for maintaining viral circulation in certain ecological niches that serve as a constant source of infection.

## 2. Seasonal forecast for Bulgaria for the seasons winter 2020/21 and spring 2021.

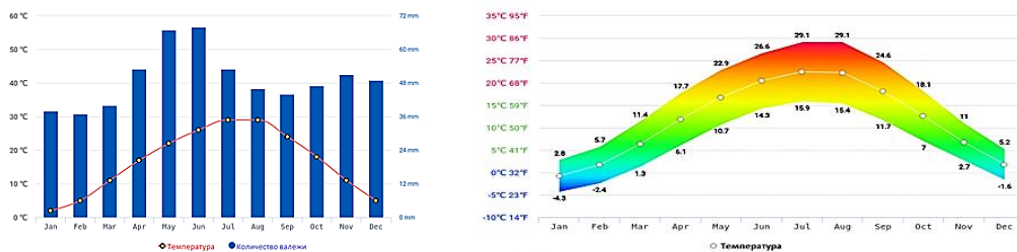
According to the forecast of the National Institute of Meteorology and Hydrology for the winter season 2020/21 and the first half of the spring 2021, the following temperatures and precipitation are expected:

**Winter season** (December-January-February): Average seasonal temperatures will be close to or higher than normal and with seasonal rainfall close to normal. The winter of 2020/21 can be expected to be similar or less warm than the winter of 2019/20 and to have higher seasonal rainfall.

**Spring season** (March-April-May): Average seasonal temperatures will be close to or higher than normal and with seasonal rainfall close to normal. The spring of 2021 can be expected to be similar to the spring of 2020.

**Monthly average climatic data** (average annual monthly temperatures): The monthly average temperatures and precipitations in Bulgaria for the period 1896 – 2018 and the average temperature during the day (day and night) for Bulgaria are given in the following table and diagrams:

Month	Temperatures	Rainfalls
January	2° C	38 MM
February	5° C	37 MM
March	11° C	40 MM
April	17° C	53 MM
May	22° C	67 MM
June	26° C	68 MM
July	29° C	53 MM
August	29° C	46 MM
September	24° C	44 MM
October	18° C	47 MM
November	11° C	51 MM
December	5° C	49 MM



### 3. Vaccines, immunity, organisation of the ruminants' BT vaccination campaign

In the summer of 2014, the BFSA carried out emergency vaccination of the entire livestock – cattle and sheep under a program approved by the European Commission. Vaccine "BTVPUR AISap4-BG" was used. According to information received from the BFSA, in vaccination campaign 2021 the BLUEVAC 4BG vaccine will be used (a suspension for sheep and cattle). According to the summary of vaccine characteristics (license 0022-2608), the vaccine is intended for the prophylactic vaccination of ovine and bovine animals against bluetongue, serotype 4, strain BTV-4/SPA-1/2004  $10^{6.5}$ CCID<sub>50</sub>. The vaccine builds active immunity 3 weeks after the main vaccination scheme, with a duration of immunity of 1 year. Rare adverse reactions listed in section 4.6 of the Summary of Product Characteristics have been reported. The Bulgarian Food Safety Agency plans to vaccinate 826,800 cattle and 1,448,000 sheep. Vaccination will be performed by approximately 900 registered veterinarians within about 60 days of vaccination **campaign**.

#### Conclusion and recommendation

In analyzing the impact of the various risk factors listed above, the following should be taken into account when determining the most appropriate period to start bluetongue vaccination for 2021:

1. Increasing the average daily temperatures to and above 10° C (March – April 2021). In view of the different temperature differences in the different regions of Bulgaria, it would be appropriate to start the vaccination **firstly in the southern regions of the country**, in view of the more favourable conditions for the development of the vectors.
2. The vaccine should be completed **at least 21 days (three weeks) before the active flight of the relevant vectors**.
3. The possibilities and resources of the BFSA to distribute the vaccine and of the registered veterinarians to carry out the vaccination.
4. In case of other vaccination schemes with live vaccines for the control of diseases in ruminant, vaccination for bluetongue must begin **at least 28 days after the end of the last (previous) vaccination with live vaccine**.
5. When vaccinating ruminants, it should be considered that:
  - the presence of colostrum antibodies interferes with the immunization of the new born for more than 3 months after birth,
  - the minimum time after vaccination of an animal to be considered immune may be up to 48 days.

Taking into account the life cycle of the vectors, the temperatures at which they begin to become active and the time for cattle and sheep to build active immunity, we recommend that vaccina-

tion in 2021 **should begin in the second half of February 2021 at the earliest**. For Southern Bulgaria it can start in the first half of March, and for Northern Bulgaria – the second half of March 2021.

## References

1. Caracappa S., Torina A., Guercio A, Vitale F, Calabro A., Purpari G .(2003). *Identification of a novel bluetongue virus vector species of Culicoides in Sicily*. Vet Rec. 2003; 153:71–4. Link: <https://doi.org/10.1136/vr.153.3.71>.
2. European Commission, Union Register lists all medicinal products for human and veterinary use, BLUEVAC 4 BG suspension for injection for sheep and cattle: [https://ec.europa.eu/health/documents/community-register/2011/2011041499868/anx\\_99868\\_bg.pdf](https://ec.europa.eu/health/documents/community-register/2011/2011041499868/anx_99868_bg.pdf).
3. Georgiev G., N. Nedelchev. (2008). *Epidemiological features of bluetongue in the countries of the European Union in 2008 and recommendations for prevention and control*. Vet. Collection 2008.
4. Georgiev G. (2020). *Scientific opinion for assessment of the risk of recurrence of bluetongue (BTV-4) in ruminants on the territory of the Republic of Bulgaria in 2020*. Center for Risk Assessment, website: [https://corhv.government.bg/?cat=71&news\\_id=1265](https://corhv.government.bg/?cat=71&news_id=1265).
5. Gerbier G., Biteau-Coroller F., Guis H., Tran A., Ziantara S., Baldet T. (2006). *Fièvre catarrhale ovine: le point sur l'épidémiologie en Europe fin 2006*. Bulletin des Groupements Techniques Vétérinaires. 2007; 39:81–6.
6. Mellor PS. (2004). *Infection of the vectors and bluetongue epidemiology in Europe*. Vet Ital. 2004; 40:167–74.
7. Mertens P., Attoui H., Bamford D. H. (2007). *The RNAs and proteins of dsRNA viruses*, Institute for Animal Health, Pirbright, UK. Available from [https://wwwnc.cdc.gov/eid/article/14/4/07-1441\\_article](https://wwwnc.cdc.gov/eid/article/14/4/07-1441_article).
8. Sailleau C., Bréard E., Gerbier G., Parodi J., Bouchot A., Zientara S. (2004). *Epidémiologie descriptive et moléculaire de la bluetongue en Corse en 2004*. Epidémiol et santé anim. 2004;48:9–14
9. Tran A., Biteau-Coroller F., Guis H., Roger F. (2005). *Modélisation des maladies vectorielles*. Epidémiol et Santé Anim. 2005; 47:35–51.