Animal Health

Seasonal Behavior of Leptospirosis in Horses during a Decade in Camagüey

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ABSTRACT

Background: Leptospirosis is the most widely spread zoonosis during the 2000s. Numerous animal species act as reservoirs of spirochetes. The aim of this research was to establish its seasonal behavior in equines.

Methods: In that sense, the data from 1 099 equine serum reactive to *Leptospira* collected on a monthly basis for 10 years, were used. Seasonal decomposition was performed by the multiplicative method, which helped set seasonality in quarters, according to the proportion of positive reactors for the ten-year period.

Results: The greatest proportion of reactors took place in October, November, and December, when the seasonal factor was above 100%. It coincided with the dry period, which did not correspond to most reports on humans and other animal species.

Conclusions: Most horses reactive to *Leptospira* corresponded with the fourth quarter of the period studied: in the dry season, which contrasts most reports. Therefore, further studies should be conducted.

Key words: *seasonality, horses, Leptospira, zoonosis*

INTRODUCTION

Leptospirosis is the most widely spread zoonosis during the 2000s. It affects both industrial and developing countries (Ghazaei, 2018). Several animal species act as reservoirs and play an outstanding role within the transmission chain of pathogenic serovars to humans (Barreto and Rodríguez, 2018). However, horses are mistakenly excluded from the group of species posing the highest risks (Rodríguez, Barreto, García, and Vázquez, 2017a).

In January 2013, following a severe tropical storm in Rio de Janeiro, a team of Brazilian researchers reported the presence of *Leptospira* in the urine of sero-reactive equines, which was later confirmed through molecular assays (Polymerase Chain Reaction _PCR_), though several attempts to culture the agent were unsuccessful (Hamond *et al.*, 2013). This is the first official report on the potential of this animal species as a reservoir for the transmission of the etiological agent in urban areas.

In Camagüey province, there are 84 314 horses, of which 70 714 belong to private owners (Rodríguez *et al.*, 2017a). Quite recent research confirmed that this species shows a similar behavior to swine, cattle, and canines in Camagüey. These are hegemonic reservoirs of leptospirosis (Rodríguez *et al.*, 2017a, b; Barreto *et al.*, 2017).

The aim of this research was to evaluate the possible seasonality of leptospirosis in horses.

MATERIALS AND METHODS

The investigation was conducted at the Provincial Animal Health Laboratory (LPS), in Camagüey. Overall, 1 099 *Leptospira* reactive horses, previously identified by microagglutination (Rodríguez *et al.*, 2017a), and thanks to the information gathered from every case in all 10 years of study, were included.

Seasonality was based on a sequence graph to determine the seasonal decomposition method to be used. Finally, the multiplicative method was used to establish seasonality in the proportion of *Leptospira*-reactive animals in a three-month period along the research.

RESULTS AND DISCUSSION

The greatest proportion of positive reactors took place during the fourth quarter (October, November, and December) when the seasonal factor was above 100% (Table 1) during the rainy season in Cuba.

Table 1. Seasonal behavior of leptospirosis (2004-13)

Period (quarters)	Seasonal factor (%)
1	101.5
2	81.9
3	80.8
4	135.8

In a study on the epidemiological behavior of this zoonosis in humans and animals in the province of Villa Clara, Castillo-Cuenca *et al.* (2016) concluded that it is cyclical and seasonal, with epidemic outbreaks in summer and fall, and bi-annual inter-epidemic periods, with the most frequent outbreaks in the rainy months. Although their results in relation to seasonality correspond to most reports, their assertion that *Leptospira* infections in humans and animals tends to decrease is very different from international reports (Chatterjee, Bhaumik, Chauhany, Kakkar, 2017; Barreto, and Rodríguez, 2018).

Upon assessment of the disease in the Americas, a team of Mexican and Colombian researchers noted that in most cases affecting humans, it develops in tropical and subtropical areas, around flooded areas. Later, they stressed that the highest peaks were observed in the rainy months (June through November) (Torres Castro, Hernández Betancourt, Agudelo Florez, Arroyave Sierra, Zavala Castro, and Puerto Fernando, 2018). Although these authors recognize the potential of equines as reservoirs of *Leptospira* spp, their results were not based on this species.

Particularly in horses, Hamond *et al.* (2013) highlighted that the disease is more frequent after tropical phenomena linked to heavy rains and floods, especially when temperatures are high. Other researchers, who also refer to the disease in Brazil, share the same criterion (Oliveira, Leal, Correia, Serufo Filho, Dias, and Serufo, 2017).

Due to the seeming contradictions between the reports and the actual outcome, it is important to note that the particularities of tropical areas may have had a remarkable influence. Several factors that go beyond climate, topography, and other environmental elements are deciding the behavior of the disease, as well as the prevalence of the serovars involved (Martins and Lilenbaum, 2013).

These results can also be influenced by the origin and size of the samples, the variables evaluated, and the statistical method applied, which is often missing (Barreto, Barreto, Rodríguez, García, and Vázquez, 2017). Another striking factor might be the underestimation made of the disease in the Latin American context (Torres Castro, Hernández Betancourt, Agudelo Florez, Arroyave Sierra, Zavala Castro, and Puerto Fernando, 2018), which has led to mistaken conclusions in patients suffering from tropical fever condition, seemingly attributable to dengue, though similar numbers have been caused by *Leptospira* spp. (Mattar, Tique, Miranda, Montes, and Garzon, 2017).

One instance of the above is a research done in Korea which included 1 226 purebred horses that was supported by surveys, rather than laboratory tests. Most reactors were observed during the dry season (Jung, Lee, and Ha, 2010).

Finally, even when the serovar involved was not considered in the proposal for discussion, a research done in Uppsala, Switzerland including 2 017 horses concluded that the seroprevalence of Bratislava increased during the April-May-July and October-November-December quarters, whereas Icterohaemor-

rhagiae took place only in the second quarter of the year (Båverud *et al.*, 2015). The researchers also added that their occurrence was favored by the age of animals.

These cases demonstrated that further studies on seasonal behavior of leptospirosis, at least for equines, should include other factors in addition to variables month and year. Animal race and age, along with the serovar types studied might contribute to better understanding of this zoonosis.

CONCLUSIONS

The highest proportion of horses reactive to *Leptospira* was associated to seasonality (seasonal factor >100%), during the October-November-December quarter throughout the ten years of the study. Its occurrence during the dry season has shown a different outcome than most reports; hence, further studies must be conducted in that direction.

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CONFLICT OF INTERESTS: None