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Seasonal Behavior of *Fasciola hepatica* in Sacrificed Bovines at Chacuba Slaughterhouse, Camagüey, Cuba

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ABSTRACT

To determine the existence of seasonal patterns for *Fasciola hepatica* infestation in bovines slaughtered in the province of Camaguey, Cuba, information gathered from 13 059 bovines sacrificed at the Chacuba slaughterhouse (Terso Livestock Basic Marketing Company, Maraguan Livestock Company), between 2008 and 2014, was used. The study included 2 387 animals affected by *F. hepatica*, according to the anatomical and pathological diagnostic made at the slaughterhouse. Prevalence calculations were based on the sacrificed and affected animals (18.27%) for the entire period. The seasonal decomposition process was based on additive model. It revealed the existence of seasonal behavior for the animals affected by *Fasciola hepatica* and its prevalence. The seasonal patterns had peaks in February, October and December for the two variables studied. Evaluation of intermediate hosts dynamics and larval *F. hepatica* stages were associated to the seasonal patterns observed.

Key words: *seasonability, Fasciola hepatica, cattle, parasite infections*

INTRODUCTION

Fascioliasis is an anthroponotic disease, that mostly affects bovines and ovines, in Cuba, both in state-owned and private areas (Vázquez, Gutiérrez, Sánchez, 2010). *Fasciola hepatica* is a devastating trematode that impacts the economy and the physical health of animals, whose recent increase has been attributed to climatic change (Fox et al., 2011).

Climate has an impact on the parasite´s free life stages, and *Lymnaea truncatula,* as an intermediate host. Temperature and rainfall interactions play a crucial role on the efficacy of transmission (Fox *et al*., 2011; Allison, Matthew, Pinchbeck and Williams, 2015).

A study made between 2008-2013, in a slaughterhouse in the province of Camagüey, Cuba, revealed the existence of variability in the prevalence of *F. hepatica* due to year influence, the municipality the animals come from, and the climatic factors, particularly rainfall average (Arteaga, 2014).

In Cuba, there are two well defined climatic seasons (dry and rainy). They have a critical influence on pasture availability, the basis of dairy production (García, Betancourt, Guevara, Fajardo and Évora, 2005). Seasonal behavior patterns have been established in cattle systems for breeding-related variables (Ramírez *et al*., 2010; Figueroa, Bertot and Vázquez, 2010), but no such references have been published for issues concerning animal health.

The aim of this paper was to determine seasonability of *F. hepatica* infestation in sacrificed bovines in the province of Camaguey, Cuba.

MATERIALS AND METHODS

Location and duration

The study used the records of 13 059 sacrificed bovines from January 2008 and December 2014, at the Chacuba industrial slaughterhouse Company, Terso Marketing Company, from the Maraguan Livestock Company, in the province of Camaguey, Cuba.

Variables used

The monthly data from sacrificed animals, and animals affected by *F. hepatica* (resulting from anatomic and pathological diagnostics made at the slaughterhouse), were used. Prevalence was calculated as follows,

Prevalence= (affected animals/sacrificed animals) *100

Statistical analysis

The data were registered monthly between 2008 and 2014, to make up time series. Year (non-periodic variable), month (12 periods), and date were determined to perform descriptive analysis (auto-correlation, partial auto-correlation, and crossed correlation between variable pairs) of time series.

Considering the behavior of the month pattern for the variables, an additive model was used to carry out seasonal decomposition. All statistical analyses were made with Statgraphics Centurión XVI Version 16.1.18 (Statpoint, Inc. 1982-2012).

RESULTS AND DISCUSSION

The number of sacrificed animals was higher in 2008, 2009, 2010 and 2014, with the greatest prevalence for *F. hepatica* in 2010, 2011, and 2013. In the first three years of the series, the total number of affected animals was practically stable (Table 1).

These differences in annual prevalence may be attributed to climatic variations, since larval development and survival of *F. hepatica* on the grass relied on precipitations, relative humidity and temperature (Ticona, Chávez, Casas and Chavera, 2010). So it is frequently observed in regions with elevated rainfall, and soils with poor drainage and high water retention. These conditions are favorable to survival and multiplication of the intermediate host (*Galba cubensis* and *Pseudosuccinea columella*), and the transmission of the parasite (Bosco, Rinaldi and Musella, 2015; Caminade and Van Dijk, 2015).

The eggs released through the biliary ducts into the outside through feces. In 9-14 days they develop another evolutionary stage, miracidia. Finally, the cycle within the snail lasts between 5-6 weeks. It will take 10-12 weeks from ingestion of the infecting stage, until the sexually mature parasites begin to get rid of eggs through feces (Escalona, 2012; León, Silveira, Pérez and Olazábal, 2013; Bennema, Scholte, Molento, Medeiros and Carvalho, 2014).

The best temperature for *F. hepatica* can develop in the snail should be above 10 ºC. Therefore, it is almost inexistent during the dry season, anywhere. During the rainy season, all eggs are incubated (Vázquez, Sánchez, Alba and Pointier, 2015).

Moreover, the application of mathematical models created in Europe included climatic variables from data collected in Camaguey, in 2013. Van Dijk *et al*. (2016) showed an increase in the number of metacercaria in the grass, during the rainy season, when the temperatures are warmer.

Table 2 shows the highest values of seasonability for the animals affected between February-April, October and December. Meanwhile, the animals affected in February, October and December corresponded to the prevalence behavior.

The activity observed in annual sub-series for the sacrificed animals was appealing, with unusual behaviors in 2008, 2009 and 2014 (Fig. 1). Hence, the absence of a common seasonal pattern may be a reasonable conclusion. On the contrary, the affected animals showed coincidences in case decline, in June-September, and the peaks in February and October (Fig. 2). Although in 2009 and 2010 certain peaks were observed in December, the existence of a common seasonal behavior pattern for all the years may have been considered.

The environmental conditions stimulate snail and larvae growth of *F. hepatica*. The infestation produced in the dry season is much less important than the one that takes place in the rainy season, probably caused by the high mortality rate of snails during the dry season, and particularly, the mortality of infected snails (Selemetas, 2015). In this study, prevalence had the highest values in February and October, during the study (Fig. 3). A similar behavior was observed for the annual sub-series, except in 2008 and 2015.

The seasonal indexes and the behavior of annual sub-series observed, evidenced their importance and the dependence of the slaughterhouse findings on the climatic conditions. It can be explained by the behavior of the disease, widely documented in the scientific literature (Bennema, Scholte, Molento, Medeiros and Carvalho, 2014; Van Dijk *et al*., 2016; Giménes, Núñes, Chamorro and Alarcón, 2014, and Robertson, 2014).

The results achieved proved the existence of a seasonal behavior for the animals affected with *F. hepatica* under the conditions of Camaguey in sacrificed bovines, and the prevalence of the disease characterized by peaks in February and October, respectively.

CONCLUSIONS

Evaluation of intermediate host dynamics and larval stages of *F. hepatica* should be evaluated to establish a relationship with the seasonal patterns observed in infested, sacrificed bovines, and its prevalence.

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Table 1. Case summary

Year	Affected animals Animals	Affected animals	Prevalence (%)
2008	2452	493	20.11
2009	1960	416	21.22
2010	1620	484	29.88
2011	991	254	25.63
2012	879	162	18.43
2013	797	184	23.09
2014	4360	394	9.03
Total	13059	2387	18.27

Table 22. Seasonal indexes for the variables studied

Month	Sacrificed animals	Affected animals	Prevalence (%)
1	-31.61	-9.52	-6.45
2	63.11	20.19	32.61
3	38.11	0.33	-0.03
4	23.59	1.50	-5.10
5	-23.24	-4.34	-20.61
6	-46.88	-11.73	-17.16
7	-50.47	-15.71	-12.90
8	-10.92	-5.82	-10.41
9	0.18	-3.20	-4.17
10	32.65	11.67	15.24
11	-38.44	-4.70	-0.47
12	43.92	21.32	29.46

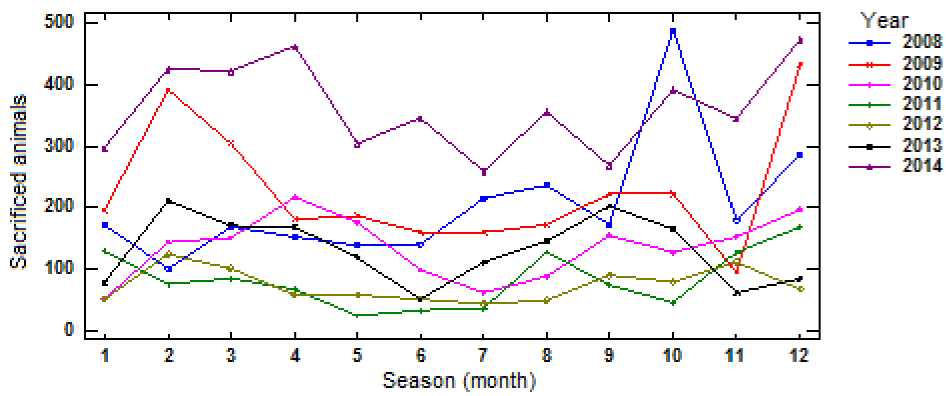

Fig. 1. Annual sub-series for the sacrificed animals

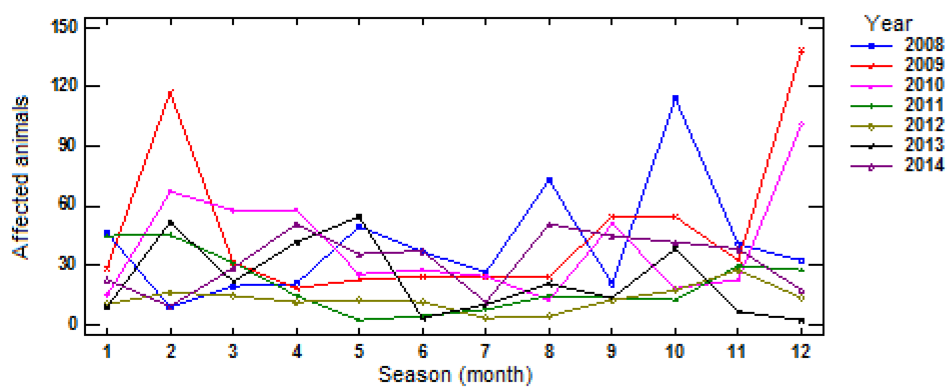

Fig. 2. Annual sub-series for the affected animals

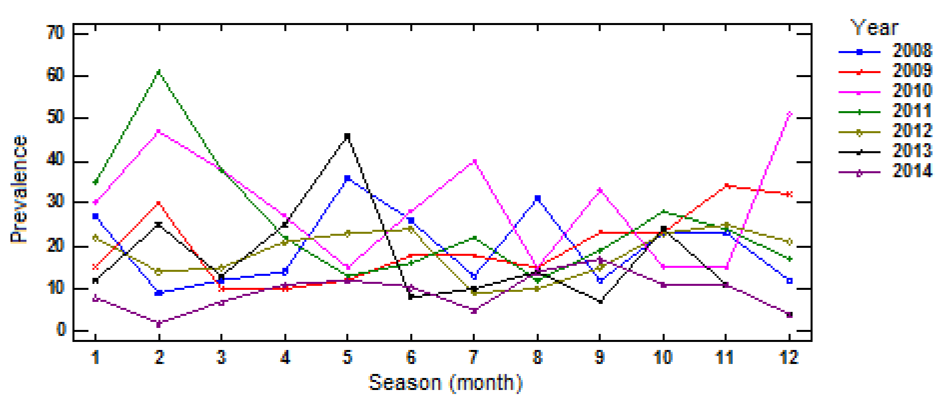

Fig. 3. Annual sub-series for prevalence