SOME ASPECTS OF THE EPIDEMIOLOGY OF *BABESIA BOVIS* IN SANTANA DO LIVRAMENTO, SOUTHERN BRAZIL.

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SUMMARY: Some aspects of the epidemiology of *Babesia bovis* were studied in Santana do Livramento, Rio Grande do Sul, Brazil, by analysing cattle raising practices applied in 101 herds and by diagnosing *B. bovis* antibodies in cattle approximately 11-months-old using an enzyme linked immunosorbent assay (ELISA). Herds whose seroprevalence ranged between 15% and 80% were considered to be at risk of babesiosis outbreaks of economic importance (enzootic instability zone). Fifty three per cent of herds were found to be in enzootic instability zone for *B. bovis*. The proportion of *Bos taurus* herds (53%) when compared to herds of *B. indicus* x *B. taurus* (51%) in instability were similar (P=0.771, chi square) and the number of acaricide treatments applied annually was not statiscally significant related to instability to *B. bovis* (P=0.866). Herds maintained along with sheep in a ratio <1.5 : 1 sheep/cattle had a greater chance of being in enzootic stability zone due to the high antibody prevalence when compared to herds kept with a higher sheep/cattle ratio (P=0.090). The probability of enzootic stability increased significantly if the herds with a low ovine/bovine ratio were from properties greater than 500 ha (P= 0.057). High *B. bovis* antibody prevalences were found in *B. taurus* x *B. indicus* herds subjected to an average of 5.8 tick treatments yearly with long residual period acaricides. This indicates misuse of the chemicals, or tick resistance to them. The epidemiological situation of *B. bovis* in this region seems to justify the use of live vaccines against *B. bovis* to prevent economic losses caused by this protozoan.

KEY WORDS: Epidemiology, Prevalence, Antibodies, *B. bovis*, Cattle, Southern Brazil.

INTRODUCTION

Bovine babesiosis caused by *Babesia bovis* and *Babesia bigemina* is the most important cattle disease transmitted by *Boophilus microplus* ticks in tropical and subtropical areas of South America (GUGLIELMONE, *in press*). Calves are protected by non-specific immunity to about seven months of age (VOS *et alii* 1987; GUGLIELMONE *et alii.*, 1992). Infection during this period induces a long-lasting immunity, whereas primary infection later in life can produce severe illness (MAHONEY *et alii.*, 1973, 1979). Therefore the likelihood of babesiosis outbreaks occurrence can be indirectly measured by detecting the proportion of infected calves *via* diagnosing babesial antibodies prevalence (FAO, 1984).

Bos indicus x *Bos taurus* cattle, that are more resistant to *B. microplus* infestations than *B. taurus* breeds (LEMOS *et alii*, 1985; SUTHERST *et alii*, 1988; GUGLIELMONE *et alii*, *in press*) are commonly abundant in this region. Moreover, cattle and sheep are usually raised together. This is relevant in that most of *B. microplus* larvae picked up by sheep will not complete their life cycle. Therefore, the use of sheep has been suggested as a factor which decreases population densities of *B. microplus* and thereby decrease the use of acaricides (EVANS *et alii*, 1992).

Farmers and veterinary practitioners claim that under the conditions above, "tristeza parasitária" (a regional term used to describe cattle babesiosis and anaplasmosis) is a serious economic problem, but epidemiological information on this disease is scarce. In this article we describe some aspects of the epidemiology of babesiosis caused by *B. bovis* in Santana do Livramento. Rio Grande do Sul. Our results are based on a survey of producers, their cattle management practices, and the seroprevalence of *B. bovis* antibodies in their herds.

MATERIALS AND METHODS

A questionnaire was sent to 101 livestock producers who had been asked to answer the following: 1) their opinion on the importance of tick-borne diseases in their herds. 2) cattle biotypes (*B. taurus*, *B. taurus* x *B. indicus* or *B. indicus*), 3) size of the property (greater than or less than 500 ha), 4) number of cattle and sheep, and 5) number of annual treatments against ticks. The herds were located to the North-East of the town of Santana do Livramento (30° 53' 18" S 55° 31' 56" W) forming a circle to the South-West; (the maximum distance from the town to a herd was 100 km).

For *B. bovis* serology, a minimum of 20 blood samples from each herd had been obtained from cattle about 11 months-old. Serological tests were performed with an enzyme linked immunosorbent assay (ELISA) provided by the joint division of Food and Agricultural Organization-International Atomic Energy Agency, whose guidelines to perform the test were followed (FAO-IAEA, 1992). The ELISA test was used only after confirming an agreement of 90% with the traditional immunofluorescent antibody test (MARTINS, 1992). Herds with prevalence of *B. bovis* between 15% to 80% were considered as living in a high risk area in relation to the possibility of suffering babesiosis outbreaks of economic importance (enzootic unstability, FAO, 1984). Chi square test was used for statistical analysis.

RESULTS

Not all questionnaires were completely fulfilled, therefore the total number of answers for each question varied accordingly. Ninety percent of producers said that "tristeza parasitária" was a problem in their herds, mainly in cattle older than 12 months. Fifty four herds (53% of the total) were within the area of enzootic instability to *B. bovis*. Of the remaining 47 herds (47% of the total) in enzootic stability zone, 41 (87.2%) were classified as such because of a high prevalence (>80%) of *B. bovis* antibodies and the remainders (12.8%) due to low antibody prevalence (<15%).

The majority of herds were *B. taurus* x *B. indicus* (n-82) or *B. taurus* (n=16), 53% and 51% of which were in enzootic instability zone, respectively (P– 0.777). All herds were treated against ticks using plunge dips; 81% of the producers used synthetic pyrethroids and 19% formamidinic compounds. The majority of the herds were treated 4-6 times yearly but it had no statistically-significant effect upon the epidemiologic conditions (Table 1). Notably two *B. taurus* herds were exposed to more than 6 annual

Table 1. Frequency of annual treatments against *Boophilus microplus* and situation of enzootic stability or instability to *Babesia bovis*.

Frequency of treatments	Annual treatments		Instability		Stability	
	Number	% total	Number	% total	Number	% total
<3	14	18a*	9	64	5	36
4-6	46	61b	26	57	20	43
>6	16	22a	9	54	7	44
	P< 0.05			P > 0.05		

*Numbers with different letters indicate statistical differences.

tick treatments were in stability zone due a high prevalence of *B. bovis* antibodies.

The size of the farms did not affect the epidemiological situation *per se*; 22 (26% of the total) had less than 500 ha and 64 (74%) had over 500 ha. However, in both cases 55% of the herds were in enzootic instability zone.

The analysis of herds grazed together with sheep at a sheep:cattle ratio > or < 1.5:1 showed that 17 herds (59%) of the total of 29 herds kept under < 1.5:1 ratio were in a stable situation due to high antibodies prevalence to *B. bovis*. The same situation was found in 30% (17 herds from a total of 56) for those herds with a ratio of > 1.5:1 (p=0.012); five herds in this ratio were in enzootic stability zone due to low antibodies prevalence.

A further inside in the *strata* of 29 herds maintained under a low ovine/bovine ratio showed that 28 of them were treated for ticks at least four times annualy using mainly pyrethroids (26 cases). Thirteen herds (76%) of the 17 herds in enzootic stability zone were kept in farms bigger than 500 ha. whereas 5 herds (42%) of the 12 in enzootic instability were from properties of this size (P– 0.057). Again, the number of treatments had no influence in the epidemiological *status* to *B. bovis*. The 17 herds in enzootic stability due to high antibodies prevalences received a mean number of 5.8 ± 1.03 acaricide treatments per year, while the 12 herds in enzootic instability were treated 5.0 ± 1.22 times yearly.

DISCUSSION

The epidemiology of *B. bovis* in Santana do Livramento appears to follow a classical model (FAO, 1984) according to the serological data obtained during this work and the opinion of farmers that "tristeza parasitária" usually affects cattle older than a year. This differs from the situation in another region of Brazil (Mato Grosso do Sul) where cattle

babesiosis is mainly a problem in cattle younger than seven months (MADRUGA *et alii*, 1986).

The proportion of herds in enzootic instability zone for *B. bovis* was high showing a regional situation under a risk of widespread outbreaks of babesiosis. The percentage of herds in instability was lower than that obtained from producers in relation to "tristeza parasitária". This may be due to an overestimation of the problem by the farmers or that "tristeza"reported by them includes outbreaks due to *B. bovis*, *B. bigemina* and *Anaplasma marginale*. The latter possibility is supported by the findings of SPATH (1986) in Argentina where 45% of outbreaks were due to anaplasmosis, 8% to *B. bigemina*, 34% to *B. bovis*, and 13% were due to a combination of both species of *Babesia*.

The reasons for enzootic instability are not apparent. In the most favourable area for *B. microplus* development in Argentina (border with south Brazil), enzootic instability to *B. bovis* in *B. taurus* x *B. indicus* cattle was related to the use of long residual acaricides such as synthetic pyrethroids (MANGOLD *et alii*, 1988) that severely decreased the density of tick populations (GUGLIELMONE, *in press*). Therefore it was expected that under high acaricidal pressure with pyrethroids, *B. taurus* x *B. indicus* herds maintained with sheep would usually be in enzootic instability zone to *B. bovis* or in enzootic stability due to low prevalence of antibodies.

A superficial analysis appears to support this prediction since 59% of the herds were in enzootic instability or having antibody prevalences lower than 15%. Nevertheless the number of tick treatments did not influence the epidemiological situation, and 13 herds maintained in properties greater than 500 ha under a sheep:cattle ratio <1.5, but treated almost 6 times/year (most of them with pyrethroids) showed antibodies prevalences higher than 80%. These facts show that the assumption was incorrect for a large number of herds. Probably the acaricides were misused and or tick resistance is starting to be a problem, as pointed out by EVANS (1992).

An alternative explanation could be that a high proportion of *B. microplus* larvae are infected with *B. bovis* in southern Brazil. However, there is no local information to support this statement while studies carried out in Australia showed that this infection rate is extremely low (MAHONEY & MIRRE, 1971).

The sheep:cattle ratio was the parameter most closely related to define the epidemiological situation to *B. bovis*. Herds maintained under a ratio <1.5 had a greater likelihood of being in enzootic stability, especially in properties larger than 500 ha. This may result from a combination of the lower effect of sheep:cattle ratio of <1.5 on tick populations in comparison with higher ratios, difficulties in gathering all

cattle for tick treatment coupled with bad management of the acaricides and/or tick resistance.

Although further information are needed to understand the epidemiology of *B. bovis* it appears that the problem justifies vaccination to prevent losses (GUGLIELMONE *et alii*, 1992). If this is implemented correctly, herds in enzootic instability zone due to low antibody prevalence will have to be included in vaccination programmes because any increase in the *B. bovis* inoculation rate may result in devastating outbreaks (GUGLIELMONE, 1994). Similar studies on the epidemiology of *B. bigemina* and *Anaplasma marginale* in this region are needed to cover all the range of *B. microplus*-borne diseases in Rio Grande do Sul.

SUMÁRIO

Alguns aspectos da epidemiologia de *Babesia bovis* foram estudados em Santana do Livramento, Rio Grande do Sul, Brasil, através de análise de práticas de manejo aplicadas sobre 101 rebanhos bovinos e pela detecção de anticorpos de *B. bovis* em bovinos com aproximadamente 11 meses de idade, utilizando-se um teste imunoenzimático (ELISA). Rebanhos com prevalência de anticorpos variando entre 15 e 80% foram considerados em risco de exposição a surtos de babesiose de importância econômica (instabilidade enzoótica). Um total de 53% dos rebanhos foram encontrados em situação de instabilidade enzoótica para *B. bovis*. A proporção de rebanhos *Bos taurus* e *B. taurus* x *B. indicus* em instabilidade foram similares (P=0.771, x^2) e o número de tratamentos carrapaticidas aplicados anualmente não teve influência na instabilidade para *B. bovis* (P=0.866, x^2). Rebanhos bovinos mantidos juntos com ovinos em uma proporção < 1.5, tiveram maiores chances de estar em situação de estabilidade enzoótica devido à alta prevalência de anticorpos do que rebanhos mantidos numa taxa proporcional ovino/bovino > 1.5 (P=0.012, x^2). Esta situação foi mais evidenciada em rebanhos mantidos em propriedades maiores de 500 ha (P 0.057, x^2). Altas prevalências de anticorpos foram encontradas em rebanhos *B. taurus* x *B. indicus* submetidos a uma média de 5,8 tratamentos carrapaticidas anuais com produtos de longo período residual, indicando falhas na aplicação ou indícios de resistência. A situação epidemiológica de *B. bovis* em Santana do Livramento justifica a recomendação de vacinação específica a fim de se evitar perdas econômicas em rebanhos em situação de instabilidade enzoótica e naqueles em estabilidade enzoótica em consequência de baixa prevalência de anticorpos.

PALAVRAS-CHAVE: Epidemiologia, Prevalência, Anticorpos, *Babesia bovis*, Bovinos.

ACKNOWLEDGEMENTS

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