

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

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Abstract

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

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 to 101 herds and by diagnosing *B. bovis* antibodies in cattle of about 11 months old using an enzyme linked immunosorbent assay. Herds with prevalence of antibodies ranging between 15% to 80 % were considered at risk of babesiosis outbreaks of economic importance (enzootic instability). Fifty three per cent of herds were found in enzootic instability to *B. bovis*. The proportion of *Bos taurus* and *B. indicus* x *B. taurus* herds in instability were similar ($P=0.771$, chi square) and the number of acaricides treatments applied yearly had no influence in the instability to *B. bovis* ($P= 0.866$, chi square). Herds maintained along with sheep in a ratio < 1.5 had greater chances to be in enzootic stability due to high antibody prevalence than herds kept under ovine/bovine ratio > 1.5 ($P= 0.012$, chi square); this probability was further increased in herds maintained on properties greater than 500 ha ($P= 0.057$, chi square). High *B. bovis* antibody prevalence was found in *B. taurus* x *B. indicus* herds subjected to an average of 5.8 tick treatments yearly with long residual period acaricides, indicating misuse of the chemicals or tick resistance to them. The epidemiological situation to *B. bovis* seems to justify vaccination to avoid economic losses in herds in enzootic instability and those in enzootic stability due to low antibody prevalence.

1. INTRODUCTION

Babesiosis (*Babesia bovis* and *Babesia bigemina*) is the most important cattle disease transmitted by *Boophilus microplus* ticks in tropical and subtropical areas in South America [1]. Calves are protected by non-specific immunity until about seven months of age [2,3]. Infection during this period induces a long-lasting immunity, whereas primary infection later in life can produce severe illness [4,5]. Therefore the likelihood of babesiosis outbreaks can be indirectly measured by detecting the proportion of infected calves via diagnosing babesial antibody prevalence [6].

The cattle industry is economically important in southern Brazil, where this activity is generally not integrated with agriculture. *Bos indicus* x *Bos taurus* cattle, which are generally more resistant to *B. microplus* infestations than *B. taurus* breeds [7,8,9] are commonly grazed 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 an aid to tick biological control, thereby diminishing the use of acaricides [10].

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 complex is scarce. In order to broaden our knowledge about this disease, cattle raising practice were obtained through a questionnaire, together with cattle sera that were processed by an enzyme linked immunosorbent assay (ELISA) to determine antibodies to *B. bovis*.

2. MATERIALS AND METHODS

A questionnaire was sent to 101 livestock owners to determine their opinion on the importance of tick-borne diseases in their herds, and to relate *B. bovis* seroprevalence to: 1) cattle biotypes (*B. taurus*, *B. taurus* x *B. indicus* or *B. indicus*); 2) property size, discriminated as larger or smaller than 500 ha; 3) ovine/bovine ratio $>$ or $<$ 1.5; 4) number and type of annual acaricide

treatments. The herds were located to the north-east of the town of Santana do Livramento 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 was obtained from cattle with an age of approximately 11 months. Serological tests were performed as described elsewhere [11] with an enzyme linked immunosorbent assay (ELISA) provided by the Joint FAO/IAEA Division. This ELISA was used after confirming an agreement of > 90% with the traditional immunofluorescent antibody test. Herds with prevalence of *B. bovis* between 15 % to 80 % were considered in a high risk area in relation to the possibility of suffering babesiosis outbreaks of economic importance [6]. Chi square test was used for statistical analysis.

3. RESULTS

Not all questionnaires were completely filled out. Therefore the total number of answers for each question varied. Ninety percent of farmers 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 those 47 herds (47% of the total) in enzootic stability, 41 were in this conditions because of *B. bovis* antibodies prevalence > 80 %, and the remainder due to antibody prevalence < 15 %.

The majority of herds were *B. taurus* x *B. indicus* (n=82) or *B. taurus* (n= 16), 53 % and 51 % of them were in enzootic instability, respectively (P= 0.777, chi square). All herds were treated against ticks using plunge dips; 81% of the grazers used pyrethroids and 19 % formamidinic compounds. The majority of the herds were treated 4-6 times/year but this had no influence on their epidemiological status.

The size of the farms did not affect the epidemiological situation per se. Twenty two farms (26% of the total) had less than 500 ha and 64 (74 %) had over 500 ha. In both cases 55 % of the herds were in enzootic instability.

The analysis of herds grazed along with sheep at a sheep:cattle ratio > or < 1.5 showed that 17 herds (59 %) of the total of 29 herds kept < 1.5 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 > 1.5 (p=0.012); five herds in this ratio were in enzootic stability due to low antibody prevalence.

In the strata of 29 herds maintained under the ovine/bovine ratio < 1.5 showed that 28 of them were treated for ticks at least four times yearly using pyrethroids in 26 cases. Thirteen herds (76%) of the 17 herds in enzootic stability 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 on the epidemiological status to *B. bovis*. The 17 herds in enzootic stability due to high antibody prevalence 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.

4. DISCUSSION

The epidemiology of *B. bovis* appears to follow a classical model [6] in Santana do Livramento, according to the serological data obtained and the opinion of farmers that "tristeza parasitária" usually affects cattle older than one year. This differs from the situation in another region of Brazil (Mato Grosso do Sul), where babesiosis is mainly a problem in cattle younger than seven months [12].

The proportion of herds in enzootic instability to *B. bovis* was high showing regions under a risk of widespread outbreaks of babesiosis. Although the percentage of herds in instability was lower than the figure obtained from the questionnaires in relation to "tristeza parasitária" this may be a result of an overestimation of the problem or that the combination of the outbreaks of *B. bovis*, *B. bigemina* and *Anaplasma marginale* could result in a problem of the magnitude indicated in the farmers questionnaire. The last situation is the most probable as was shown by Spath [13] in Argentina, where 45 % of the outbreaks were due to anaplasmosis, 8 % to *B. bigemina*, 34 % to *B. bovis* and 13 % due to combinations of both species of *Babesia*.

Nevertheless, the reasons leading to the enzootic instability were not obvious. 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 effect acaricides such as pyrethroids [14] that severely depressed tick populations [1]. 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 to *B. bovis* or in enzootic stability due to low antibody prevalence.

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 ticks did not influence the epidemiological situation, and 13 herds maintained in properties larger than 500 ha and under a sheep:cattle ratio < 1.5, but treated almost 6 times/year (most of them with pyrethroids) showed antibody prevalence higher than 80%. These facts show that the assumption was erroneous for a large number of herds. Probably the acaricides were misused or tick resistance is starting to be a problem, as pointed out by Evans [10]. 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 rate is extremely low [15].

The sheep:cattle ratio was the parameter most closely related to the epidemiological situation to *B. bovis*. Herds maintained under a ratio < 1.5 had greater chances to be in enzootic instability, especially in properties larger than 500 ha. This may result from a combination of the lower cattle ratio of < 1.5 on tick populations in comparison with higher ratios, difficulties to gather all cattle for tick treatment coupled with bad management of the acaricides and/or tick resistance.

Although further studies are needed to understand the epidemiology of *B. bovis* it appears that the problem justifies vaccination to prevent losses [3]. If this is implemented, herds in enzootic instability 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 [16]. Similar studies on the epidemiology of *B. bigemina* and *Anaplasma marginale* are needed to cover all the range of *B. microplus*-transmitted diseases in the region.

REFERENCES

- [1] GUGLIELMONE, A.A., Epidemiology of babesiosis and anaplasmosis in South and Central America, *Vet. Parasitolog.* **57** (1995) 109-119.
- [2] DE VOS, A.J., DALGLIESH, R.J., CALLOW, L.L., *Babesia*. In: Immune Response in Parasitic Infections: Immunology, Immunopathology and Immunoprophylaxis, E.J.L. Soulsby (Editor), Vol. 3. Protozoa. CRC Press, Boca Raton, FL, USA. (1987) pp. 183-222.
- [3] GUGLIELMONE, A.A., AGUIRRE, D.H., SPATH, E.J.A., GAIDO, A.B., MANGOLD, A.J., DE RIOS, L.G., Long term study of incidence and financial loss due to cattle babesiosis in an Argentinean dairy farm, *Prev. Vet. Med.* **12** (1992) 307-312.
- [4] MAHONEY, D.F., WRIGHT, I.G., MIRRE, G.B., Bovine babesiosis: The persistence of immunity to *Babesia argentina* and *B. bigemina* in calves (*Bos taurus*) after naturally acquired infection, *Ann. Trop. Med. Parasitol.* **67** (1973) 197-203.
- [5] MAHONEY, D. F., WRIGHT, I.G., GOODGER, B. V., Immunity in cattle to *Babesia bovis* after single infections with parasites of various origin, *Aust. Vet. J.* **55** (1979) 10-12.
- [6] FAO, Ticks and tick-borne diseases control. A practical field manual Vol. II. Tick-borne disease control. FAO, Rome, (1984) pp. 301-621.
- [7] LEMOS, A.M., TEODORO, R.L., OLIVEIRA, G.P., MADALENA, E.F., Comparative performance of six Holstein-Friesian x Guzera grades in Brazil, 3. Burdens of *Boophilus microplus* under field conditions, *Anim. Prod.* **41** (1985) 185-191.
- [8] SUTHERST, R.W., MAYWALD, G.F., BOURNE, A.S., SUTHERLAND, J.D., STEGEMAN, D.A., Ecology of the cattle tick (*Boophilus microplus*) in Australia. II. Resistance of different breeds of cattle, *Aust. J. Agric. Res.* **39** (1988) 299-308.
- [9] GUGLIELMONE, A.A., MANGOLD, A.J., GAIDO, A.B., AGUIRRE, D.H., Natural parasitism with *Boophilus microplus* (Acari: Ixodidae) in cattle biotypes with different

- proportions of *Bos taurus* (Spanish and British) and *Bos taurus* genes, Res. Rev. Parasitol. **53** (1992) 77-82.
- [10] EVANS, D.E., Tick infestation of livestock and tick control methods in Brazil: A situation report, Insect. Sci. Applic. **13** (1992) 629-643.
- [11] FAO/IAEA., Babesiosis ELISA kit manual. Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture, International Atomic Energy Agency, Austria (1992).
- [12] MADRUGA, C.R., BERNE, M.E.A., KESSLER, R.H., GOMES, R.F.C., LIMA, J.G., SCHENK, M.A.M., Diagnóstico da tristeza parasitária bovina no estado de Mato Grosso do Sul: inquérito de opinião, Min. Agric., Emp. Bras. Pesq. Agropec., Cent. Nac. Gado Corte, Circ. Tec. **18** (1986) 32 pp.
- [13] SPATH, E.J.A., Un estudio epidemiológico de babesiosis y anaplasmosis en el Valle de Lerma, provincia de Salta. Rev. Med. Vet. (Buenos Aires) **67** (1986) 274-276, 278-281.
- [14] MANGOLD, A.J., MARTINO, J.C., VIÑABAL, A.E., GAIDO, A.B., AGUIRRE, D.H. GUGLIELMONE, A.A., Efecto de la flumetrina aplicada por derrame dorsal para el control de infestaciones naturales de *Boophilus microplus* (Can.1988), Vet. Arg. **5** (1988) 108-110-115.
- [15] MAHONEY, D.F., MIRRE, G.B., Bovine babesiosis: estimation of rates in the tick vector *Boophilus microplus* (Canestrini), Ann. Trop. Med. Parasitol. **65** (1971) 309-317.
- [16] GUGLIELMONE, A.A., Epidemiología y prevención de los hemoparasitos (*Babesia* y *Anaplasma*) en la Argentina, In: "Enfermedades Parasitarias de Importancia Economica en Bovinos, Hemisferio Sur, Montevideo, A. Nari y C. Fiel (Editors) pp461-479.