Veterinary Parasitology 197 (2013) 168–175

Contents lists available at ScienceDirect

Veterinary Parasitology

journal homepage: www.elsevier.com/locate/vetpar

Resistance of beef cattle of two genetic groups to ectoparasites and gastrointestinal nematodes in the state of São Paulo, Brazil

M.C.S. Oliveira[a,*], M.M. Alencar[a], R. Giglioti[b], M.C.D. Beraldo[c], F.F. Aníbal[d], R.O. Correia[d], L. Boschini[a], A.C.S. Chagas[a], T.B. Bilhassi[b], H.N. Oliveira[b]

[a] Embrapa Pecuária Sudeste, Rodovia Washington Luiz, km 234, Caixa Postal 339, CEP 13560-970 São Carlos, SP, Brazil
[b] Departamento de Zootecnia, UNESP Jaboticabal, SP, Brazil
[c] UNICEP, Centro Universitário Central Paulista, São Carlos, SP, Brazil
[d] Departamento de Morfologia, UFSCar, São Carlos, SP, Brazil

ARTICLE INFO

Article history:
Received 2 April 2013
Received in revised form 5 June 2013
Accepted 29 June 2013

Keywords:
Beef cattle
Ectoparasites
Nematodes
Resistance

ABSTRACT

The resistance to infestations by ectoparasites and infections by gastrointestinal nematodes was studied in 45 animals (males and females) of two genetic groups: purebred Nelore (NI, $n = 28$) and Three-Cross (1/2 Angus + 1/4 Canchim + 1/4 Nelore – TC, $n = 17$). The animals were monitored for 24 months, during which they were left to graze in tropical pastures without receiving treatment for parasites. Each month the animals were examined for infestations by external parasites, to count the numbers of cattle ticks *Rhipicephalus microplus* with diameter greater than 4.5 mm present on the left side, horn flies (*Haematobia irritans*) present in the lumbar region and botfly larvae (*Dermatobia hominis*) present on the entire body. The *H. irritans* counts were performed with the aid of digital photographs. At the time of examination, fecal samples were collected to count the eggs per gram (EPG) and to perform coprocultures, and peripheral blood samples were drawn to determine the packed cell volume (PCV) and to count the eosinophils. For statistical analysis, the count data were transformed into $\log_{10}(n + 1)$, where n is the number of parasites. For PCV, significant effects ($P < 0.05$) were found for collection month (CO), genetic group (GG) and gender (SX), with means and respective standard errors of $41.5 \pm 0.65\%$ for the NI animals, $39.3 \pm 0.83\%$ for the TC, $41.5 \pm 0.72\%$ for the females and $39.3 \pm 0.77\%$ for the males. Regarding the eosinophil counts, only the effect of sex was significant ($P < 0.01$), with means and respective standard errors of $926.0 \pm 46.2/\mu L$, for males and $1088.0 \pm 43.8/\mu L$ of blood, for females. The NI animals presented lower mean counts for all the external parasites compared to the TC animals ($P < 0.01$). For ticks, the transformed means followed by standard errors for the NI and TC animals were 0.06 ± 0.01 and 0.34 ± 0.02, while for horn flies these were 0.92 ± 0.05 and 1.36 ± 0.06 and for botfly larvae they were 0.05 ± 0.03 and 0.45 ± 0.05, respectively. The average EPG values were only influenced by CO ($P < 0.01$). The coprocultures revealed the presence of the following endoparasites: *Haemonchus* spp., *Cooperia* spp., *Oesophagostomum* spp. and *Trichostrongylus* spp., the last in smaller proportion. There were no significant differences between the genetic groups for the endoparasite loads, except for *Cooperia* spp., which were present in greater number ($P < 0.05$) in the NI group. The results obtained in this experiment confirm previous findings of greater susceptibility of the Nelore breed to *Cooperia* spp. and high resistance to ectoparasites.

* Corresponding author. Tel.: +55 16 34115622; fax: +55 016 33615754.
E-mail addresses: marcia.sena-oliveira@embrapa.br, marcia_58@yahoo.com.br (M.C.S. Oliveira).

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http://dx.doi.org/10.1016/j.vetpar.2013.06.021

1. Introduction

Parasitic diseases affect the performance of stock breeding by causing significant reductions in production of meat and milk. Particularly in the tropics, various parasites can afflict herds simultaneously, increasing the maintenance costs and reducing productivity. In Brazil, the main problems are caused by the cattle tick (*Rhipicephalus microplus*), the horn fly (*Hematobia irritans*), larvae of the botfly (*Dermatobia hominis)* (Honer and Gomes, 1993) and infections by gastrointestinal nematodes such as *Cooperia punctata, Haemonchus placei, Trichostrongylus axei* and *Oesophagostomum radiatum.* (Nicolau et al., 2002). Control of these parasites is almost exclusively by use of chemical agents, which leads to the development of resistant parasite populations and the presence of harmful residues in food products and the environment (Castro-Janer et al., 2010). Various studies have shown that genetic resistance to various parasites can be used as an effective control method. With respect to ticks, it is widely known that *Bos indicus* animals are resistant to this parasite, and that an increase in the proportion of *B. taurus* aggravates the susceptibility of the herd (Lemos et al., 1985; Oliveira and Alencar, 1987, 1990; Oliveira et al., 1989; Silva et al., 2007). The resistance of cattle to ticks can be influenced by various factors, including self-cleaning behavior (De Castro et al., 1985), levels of eosinophils, basophils and mastocytes (De Castro and Newson, 1993), presence of specific immunoglobulin patterns (Kashino et al., 2005), T-cells (Piper et al., 2010), genes related to the expression of keratins and lipocalins (Kongsuwan et al., 2010) and hair coat characteristics (Ibelli et al., 2012), among others. The horn fly (*H. irritans*) causes yearly losses of some US$ 865 million to Brazilian cattle breeders (Bianchin et al., 2007) and *D. hominis* larvae cause annual losses to cattle breeders of around US$ 150 million a year, by reducing productivity and leather quality (Grisi et al., 2002). Moraes et al. (1986) and Gomes et al. (1996) observed that taurine animals and darker colored animals are more affected by botfly larvae.

With respect to endoparasites, studies of differences in susceptibility of various genetic groups have produced inconclusive results. In experiments conducted under tropical conditions in Australia and the United States, respectively, O'Kelly (1980) and Peña et al. (2000) observed greater resistance to gastrointestinal nematodes in *B. taurus* X *B. indicus* crossbred animals in comparison with purebred *B. taurus* cattle. In Brazil, Oliveira et al. (2009) compared the resistance of animals of the Nelore genetic group (*B. indicus*) and mixtures of taurine breeds (1/2 Nelore + 1/2 Angus and 1/2 Nelore + 1/2 Senepol) and did not find significant differences between them, although they verified that Nelore animals were more sensitive to *Cooperia* spp.

Information that can support the choice of beef cattle that are better adapted to tropical conditions is of great importance to breeders in Brazil, where exploitation of the heterosis and complementarity of breeds has allowed a significant increase in productivity. The crossing of three cattle breeds enables exploitation of the particular traits and complementary characteristics of each breed. Despite the advantages of this type of cross-breeding, such as the fact the animals present good productive indexes and the replacement females can be produced within the herd itself, little is known about the resistance of these crossbred animals to various parasites. Therefore, the objective of this experiment was to compare *B. indicus* (Nelore) and Three-Cross animals (1/2 Angus + 1/4 Canchim + 1/4 Nelore) regarding their susceptibility/resistance to the main parasites of cattle reared under tropical conditions in Brazil.

2. Materials and methods

2.1. Experimental area and meteorological data

The experiment was conducted at the research farm of the Embrapa Southeast Region Cattle Research Unit (Embrapa Pecuária Sudeste), located in the municipality of São Carlos, São Paulo state (22° 01′ S and 47° 53′ W), at an altitude of 860 m above sea level. The climate in the region is classified as Cwa on the Köeppen scale, defined as tropical of altitude with relatively dry and cool winters and hot humid summers, with average temperature in the warmest month above 22 °C. The monthly mean temperature (°C) and total rainfall (mm) were recorded at the experimental station. The average monthly temperatures ranged between 16.2 °C (June 2011) and 28.0 °C (February 2011). The rainfall varied widely, with January 2011 being the wettest month (357.8 mm) and August 2010 and July 2011 the driest months, when no rainfall was registered.

2.2. Animals

The experimental group consisted of *B. indicus* animals of the Nelore genetic group (NI, $n = 28$), of which 15 were females and 13 were males, and Three-Cross animals (1/2 Angus (*B. taurus*) + 1/4 Canchim (5/8 Charolais/zebu) + 1/4 Nelore, TC, $n = 17$), composed of 8 males and 9 females. The animals belonged to the experimental herd of Embrapa Pecuária Sudeste and had ages of 7 or 8 months at the start of the experiment. Forty days before the start of the experiment, all the animals were treated with a commercial acaricide containing amitraz (Triatox®, Schering Plough) and an anthelmintic containing albendazol (Ricobendazole®, Ouro Fino). The animals were kept in paddocks with Tanzania grass (*Panicum maximum*) under a rotating grazing system during the entire experimental period of 24 months (August 2009–July 2011) and did not receive any drug treatment until the end of the experimental period. The immunization and disease control scheme included vaccination of the females with ages between three and eight months against brucellosis and twice-yearly vaccination of all animals against foot-and-mouth disease and clostridiosis. To study the influence of coat color on infestation by botfly larvae, the animals were divided into three groups. All of the NI animals had white coats and were included in a single group (G1), while the TC animals were divided into two groups: G2, containing animals with reddish coats, and G3, containing animals with dark coats.