Frequency of gastrointestinal parasites in cattle at the southern of Sonora, Mexico

Frecuencia de parásitos gastrointestinales en bovinos del sur de Sonora, México

Munguía-Xóchihua Javier*, Leal-Franco Ivette†, Muñoz-Cabrera José†  ♦, Medina-Chu Manuel†  ♦, Reyna-Granados Javier†  ♦, López-Castro Pedro†  ♦

Department of Agronomic and Veterinary Sciences. Technological Institute of Sonora, 5 de febrero 818 south. Colonia Centro CP 85000. Cd. Obregón, Sonora. Mexico. * Responsible and correspondence author: Munguía-Xóchihua Javier. javier.munguia@itson.edu.mx, karypl05@javier.reyna@itson.edu.mxgmail.com, mcjose_54_muca@hotmail.com, alejandro_medina_chu@hotmail.com, pedro.alan@itson.edu.mx

ABSTRACT

Commonly gastroenteric parasites are a health problem in extensive livestock and could be a risk in the productive efficiency in cattle raised at the south of Sonora, Mexico. In order to determine the frequency of the different gastrointestinal parasitic genera in bovines of the southern region of Sonora, a study was divided in high-mountain (n= 218), low-mountain (n= 173), Valley1 (n= 222) and Valley2 (n= 50) regions. The feces were collected from adult cattle and calves (5 to 6 months of age) from January to March and December 2018; January to February 2019. The samples were analyzed by flotation and MacMaster techniques. The morphology was determined obtaining the L3 stage by coproculture. The Eimerias were identified prior to sporulation. The 83.03%, 56.0% and 17.56% were positive for gastrointestinal parasites in high-mountain, low-mountain and Valley1 respectively. Valley2 was negative for nematodes, but 43% were positive for Eimerias. The cattle in the study area showed a low 17.56% to high 83.03% frequency of gastroenteric parasites with the presence of one to eight genera of nematode and one to seven of Eimeria.

Keywords: Cattle, nematodes, eimeria, semiarid, mountain.

INTRODUCTION

The production of beef cattle in Sonora is developed in more than 15 million hectares of summer pastures, 83% of the state area is used, with 1.5 million head of cattle (Denogean et al., 2013). For the farmer, the weather and ecological conditions are a restrictive
element for adequate production, which depends on the potential of the forage to meet nutritional needs (Denogean et al., 2013; Retes et al., 2013). The delicate balance of nutrients and health of cattle is at constant risk by being exposed to infections by gastroenteric parasites (PGE), which significantly reduce food consumption, feed conversion and weight gain, with morbidity and mortality in animals young people (Stromberg et al., 2012).

In the abomasum, the secretory cells that affect the quantity and quality of the hydrochloric acid are damaged, which modifies the pH value up to 6.5 and the efficiency of the digestion and absorption of nutrients is reduced; affects the mineral and protein metabolism, in subclinical and chronic presentation the animals reduce their food consumption by 15 to 20%, which decreases weight gain or there is weight loss; Therefore, nutritional deficiencies are increased and livestock productivity is reduced (Torres, 2006; Biswajit et al., 2017; Oliviera et al., 2017). In some cases, acute anorexia, anemia, toxemia, tissue damage and death can be observed; usually in young animals in growth and sometimes in adults (Johansssos, 2017).

The potential economic impact of parasites in Mexico was estimated and obtained for gastroenteric nematodes US $ 445.10 and for coccidia (*Eimeria* spp.) US $ 23.78 million, based on the national population in 2013 of 32.4 million cattle (Rodríguez et al., 2017). Due to the detrimental effects on production and health, it is important to have information on the presence of PGE in the region.

The objective of this research was to determine the frequency and genera of gastroenteric parasites in cattle from four sectors of southern Sonora, Mexico.

**MATERIAL AND METHODS**

**Geographic location.** The study was conducted in a sector of the *High-mountain* and the *Low-mountain*, as well as two sectors of the southern Sonora Valley. In the *High-mountain* sector, work was carried out in the Yécora municipality, which is located 215 kilometers north of Obregón city, at an altitude of 1540 meters; The prevailing climate is mild subhumid with rains for most of the year. In February and March, the temperature reaches 24.0 °C and the annual average is 24.4 °C, with annual average precipitation of 944 mm (SMN, 2018).

In the *Low-mountain* sector, work was carried out in the Rosario municipality, in Tesopaco town, located at an altitude of 450 meters; it has a semi-dry or semi-warm climate, with a maximum average temperature of 29.2 °C and minimum of 14.2 °C. Rains predominate during July and August, with an annual average rainfall of 610.1 mm (SMN, 2018).

**Sampling.** In stockpiles of the *High-mountain* sector, 218 calves (140 males and 78 females) were sampled and from *Low-mountain* to 173 calves (130 males and 43 females); they were all cattle breeding grounds, mostly creole weaned or at the beginning
of weaning, between 5 and 10 months of age, raised extensively and free grazing. The samples from the Valley 1 region were 222 samples from 8 herds of adult dairy cattle; from the Valley 2 region, there were 50 adult cattle in summer pastures. Sampling was carried out from January to March and December 2018, and from January to February 2019, to conduct an observational and cross-sectional study (Thursfield, 2018). Sampling was carried out for convenience in the collection pens and in the herds, where sampling was allowed (Scheaffer et al., 2012).

To the stool samples, the qualitative flotation and quantitative technique of MacMaster was performed to obtain eggs per gram of feces (HGH), oocysts per gram of feces (OGH); co-culture and Baerman (Yacob et al., 2009); In the latter, the larvae (L3) present were identified based on their morphological characteristics (Pinilla et al., 2018). Sporulation technique was performed to identify Eimerias (Mitchell et al., 2012). Through the Microsoft Excel 2016 program, the results shown in descriptive statistics were obtained (Wayne, 2014).

RESULTS AND DISCUSSION

In the High-mountain were: 83.03% (181/218) positive calves and 16.97% (37/218) negative to gastroenteric parasites. The gender type for nematodes was 88.95% (161/181) positive, cestodes 19.33% (35/181) and protozoa 80.11% (145/181). The MacMaster range for each genus was: 50-900 HGH nematodes, 50-6850 HGH cestodes, 50-5050 OGH protozoa.

The most frequent genera were: Haemonchus spp. 79.5%, Oesophagostomum spp. 40.37% and Trichostrongylus spp. 34.78% (table 1). Gastroenteric nematode infections occurred in one to eight genera, the most frequent being: single 43.47% (70/161), double 25.46% (41/161) and triple 20.49% (33/161) (table 2).

In the Low-mountain it was found: 56% (97/173) positive calves and 43.93% (76/173) negative to the parasites under study. The distribution by gender was found for nematodes 86.6% (84/97), positive and protozoan 23.71% (23/97). The MacMaster range was: 50-300 HGH nematodes and 50-200 OGH protozoan.

The most frequent nematodes were: Cooperia spp. 58.33%, Haemonchus spp. 17.85% and Ostertagia spp. 17.85% (table 1).

With respect to gastroenteric nematode infections, there were one to six genera, the two most frequent were: single 80.9% and double 19.04% (table 2).
In the study the areas of High-mountain and Low-mountain were positive for nematodes in calves, which is consistent with reports where the prevalence of PGE in calves is present and increases in the months close to the year of age; the highest prevalence occurs in calves from 4 to 12 months of age, and the highest frequency between 6 and 9 months (Colina et al., 2013). Another important factor to consider is the coexistence of the calves with the adult bovines, when they are carriers of PGE they contaminate the forage and the infection of the calves is favored (Encalada et al., 2009).

The management of livestock in Sonora state mountains is known as "runs", these are done once or twice a year, is the best season between the months of October to April of the following year. Adults receive reproductive and sanitary management such as deworming and vaccination; Calves are separated and most go to pre-export stockpiles. The adult cattle that remain on the farm when dewormed once, it is not enough to control the populations of PGE; these contaminate grazing areas and calves when infected are evidenced by the results of an infection intensity for PGE from low (0-500 HGH) to medium (550-1000 HGH); It causes a delay in growth, reduced productivity and reinfection of calves due to forage contamination (Encalada et al., 2009).

Regarding the genera of PGE found, it varied in each region of the mountain, which is consistent with a study conducted, which indicates that the nematodes *Haemonchus* spp., *Mecistocirrus* spp., *Trichostrongylus* spp., *Cooperia* spp., and *Oesophagostomum* spp, are considered important from a pathological and epidemiological point of view in various geo-ecological, temperate and warm areas (Vázquez et al., 2004). In other regions of Mexico the distribution, diversity of the frequency and genus of PGE in cattle in different states is shown, and they give the guideline of the adaptation that they have to the different ecosystems such as the subtropical and tropical (Quiroz, 2011; Fernández et al., 2015; Figueroa et al., 2018; Pinilla et al., 2018). The results of the two regions of the mountains show an important advance in the knowledge of the frequency and identification of PGE, in calves in southern Sonora.

In the Valley 1 region, 17.56% (39/222) positive and 82.43% (183/222) negative for gastroenteric parasites were found. Regarding the type of gender for nematodes 17.94% (7/39) and protozoa 82.05% (32/39) positive, respectively. The MacMaster range for each parasitic genus was: 50-1100 HGH nematodes and 50-3250 OGH protozoa.
Table 1. Number and percentage of gastroenteric nematodes in cattle in four regions of southern Sonora

<table>
<thead>
<tr>
<th>Nematodes</th>
<th>High-mountain Frequency</th>
<th>Percentage (%)</th>
<th>Low-mountain Frequency</th>
<th>Percentage (%)</th>
<th>Valley 1 Frequency</th>
<th>Percentage (%)</th>
<th>Valley 2 Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haemonchus spp.</td>
<td>128</td>
<td>79.5</td>
<td>15</td>
<td>17.85</td>
<td>6</td>
<td>50</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Oesophagostomum spp.</td>
<td>65</td>
<td>40.37</td>
<td>7</td>
<td>8.33</td>
<td>1</td>
<td>8.33</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Trichostrongylus spp.</td>
<td>56</td>
<td>34.78</td>
<td>7</td>
<td>8.33</td>
<td>3</td>
<td>25</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Skrjabinema spp.</td>
<td>40</td>
<td>24.84</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>8.33</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Cooperia spp.</td>
<td>23</td>
<td>14.28</td>
<td>49</td>
<td>58.33</td>
<td>1</td>
<td>8.33</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Strongyloides spp.</td>
<td>18</td>
<td>11.18</td>
<td>4</td>
<td>4.76</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Ostertagia spp.</td>
<td>14</td>
<td>8.69</td>
<td>15</td>
<td>17.85</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Toxacara spp.</td>
<td>1</td>
<td>0.62</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

In infections due to gastroenteric nematodes, there were one to five genera, with a double 71.43% and simple 28.5%.

In the Valley 2 region, the presence of PGE was not found and for protozoa, 46% (23/50) positive were obtained, the MacMaster range was 50-100 OGH. The results for NGE of the Valle 1 and Valle 2 regions are less frequent and this may be influenced by the age of the animals in the sampling that were adults (Encalada et al., 2009), the sanitary management of deworming of the herd before sampling; as well as the semi-arid climate conditions of the region (Martínez and Merino, 2011; Baumgard and Rhoads, 2013), which does not favor the formation and viability of the infecting larvae in the environment (table 2).

Table 2. Type of infection by gastroenteric nematodes in cattle four regions of southern Sonora

<table>
<thead>
<tr>
<th>Type of infection</th>
<th>High-mountain Frequency</th>
<th>Percentage (%)</th>
<th>Low-mountain Frequency</th>
<th>Percentage (%)</th>
<th>Valley1 Frequency</th>
<th>Percentage (%)</th>
<th>Valley2 Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple</td>
<td>70</td>
<td>43.47</td>
<td>68</td>
<td>80.9</td>
<td>2</td>
<td>28.5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Double</td>
<td>41</td>
<td>25.46</td>
<td>16</td>
<td>19.04</td>
<td>5</td>
<td>71.43</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Triple</td>
<td>33</td>
<td>20.49</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Quadruple</td>
<td>16</td>
<td>9.93</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Quintuple</td>
<td>1</td>
<td>0.62</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

With respect to the protozoa in the High-mountain, the three most frequent species were: *E. bovis* 69.65%, *E. alabamensis* 34.48% and *E. ellipsoidalis* 24.13%. In the Low-mountain, *E. bovis* 65.21% and *E. alabamensis* predominated 43.47%. In the Valle 1 region the most abundant was *E. bovis* with 46.5%. In Valley 2 *E. ellipsoidalis* and *E. bukidonensis* were found with 25% respectively (table 3).
Coccidia infections in High-mountain occurred from one to six genera of *Eimeria*, the three most frequent were: single 33.10%, double 30.34% and triple 16.55%. In Low-mountain: 43.48% single and 56.52% double. Valley 1 region was simple 71.88% and double 15.63% and Valley 2 region simple 66.66% and double with 33.33% (table 4).

### Table 3. Number and percentage of Eimerias identified from cattle from four regions of southern Sonora

<table>
<thead>
<tr>
<th>Protozoa</th>
<th>High-mountain Frequency</th>
<th>Percentage (%)</th>
<th>Sierra baja</th>
<th>Percentage (%)</th>
<th>Valle 1</th>
<th>Percentage (%)</th>
<th>Valle 2</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>E. bovis</em></td>
<td>101</td>
<td>69.65</td>
<td>13</td>
<td>62.21</td>
<td>15</td>
<td>46.5</td>
<td>1</td>
<td>12.5</td>
</tr>
<tr>
<td><em>E. alabamensis</em></td>
<td>50</td>
<td>34.48</td>
<td>10</td>
<td>43.47</td>
<td>2</td>
<td>6.25</td>
<td>1</td>
<td>12.5</td>
</tr>
<tr>
<td><em>E. ellipsoidalis</em></td>
<td>35</td>
<td>24.13</td>
<td>3</td>
<td>13.04</td>
<td>6</td>
<td>21.85</td>
<td>2</td>
<td>25</td>
</tr>
<tr>
<td><em>E. auburnensis</em></td>
<td>34</td>
<td>23.44</td>
<td>2</td>
<td>8.69</td>
<td>3</td>
<td>9.37</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>E. bukidnonensis</em></td>
<td>28</td>
<td>19.31</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>12.5</td>
<td>2</td>
<td>25</td>
</tr>
<tr>
<td><em>E. subspherica</em></td>
<td>26</td>
<td>17.93</td>
<td>1</td>
<td>4.34</td>
<td>7</td>
<td>21.85</td>
<td>1</td>
<td>12.5</td>
</tr>
<tr>
<td><em>E. zuernii</em></td>
<td>20</td>
<td>13.79</td>
<td>1</td>
<td>4.34</td>
<td>9</td>
<td>28.15</td>
<td>1</td>
<td>12.5</td>
</tr>
</tbody>
</table>

In this study the zones of Valley 1 and Valley 2, several species of *Eimeria* were positive; This is consistent with works that report that there are at least 13 species of *Eimeria* that infect cattle, but only some are very pathogenic such as *E. bovis* and *E. zuernii* (Das et al., 2015; Pascoti et al., 2011) and *E. alabamensis* (Das et al., 2015). In roofed pens, *E. ellipsoidalis*, *E. alabamensis* and *E. auburnensis* are reported (Mitchell et al., 2012; Forslid et al., 2015).

*Eimeria* infections can cause severe diarrhea, feces containing blood, fibrin and intestinal tissue; the signs are fever, pain, tenesmus, anemia, dehydration, weakness, anemia and weight loss (Pascoti et al., 2011). This complex of effects has considerable clinical and economic consequences. In endemic areas, first-year calves are at high risk of developing clinical coccidiosis, and infections by several species are common; *E. bovis*, *E. zuernii* and *E. alabamensis* being more common, during the first two weeks of life (Samson et al., 2006; Pascoti et al., 2011), and up to 12 months of age (Mitchell et al., 2012; Forslid et al., 2015). It is estimated that losses due to reduction in feed efficiency are 25 to 60% per...
calf, and a 6 to 8% annual loss due to eimeriosis was predicted with a simulator model (Lassen and Osstergaard, 2012).

Various studies have been conducted in different countries such as Peru, Brazil, the United States, India and England; where the most frequent Eimerias identified were: *E. bovis*, *E. zuernii*, *E. auburnensis*, *E. ellipsoidalis*; less frequently *E. subspherica*, *E. bokitonesis*, *E. cylindrica*, *E. Canadensis* and *E. alabamensis* (Pascoti et al., 2011; Mitchell et al., 2012; Colina et al., 2013; Lucas et al., 2014; Das et al., 2015).

In Mexico, studies conducted on bovines in Yucatán and Guerrero, the most frequent Eimerias were: *E. bovis*, *E. ellipsoidalis* and *E. zuerni*; to a lesser extent, we found: *E. auburnensis* and *E. canadensis* and *E. parva* (Rodríguez et al., 1996; Figueroa et al., 2018).

In the present investigation, the four sectors had presence of *E. bovis*, *E. alabamensis*, *E. ellipsoidalis* and *E. auburnensis*, their frequency varies by different age groups and environmental conditions; this indicates the viability of sporulated oocysts, which is more than one year (Lucas et al., 2014). Most studies of natural *Eimeria* infections in cattle confirm that calves under one year of age have a high prevalence of infection and eliminate the greatest number of oocysts by feces into the environment (Colina et al., 2013; Lucas et al., 2014). Transmission is influenced by adult cattle that are asymptomatic carriers, which favor frequent infection in young animals (Mitchell et al., 2012; Colina et al., 2013); which can occur in the rest areas or "dumps" and grazing within the summer pastures, as well as in the housing pens.

**CONCLUSION**

It is shown that cattle raised in the study area showed a frequency of low 17.56% to high 83.03% of gastroenteric parasites, with the presence of one to eight nematode genera; and from one to seven genera of protozoa.

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**CITED LITERATURE**


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