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editor@iajavs.com
iajavs.editor@gmail.com



Prevalence of bovine brucellosis and tuberculosis in production units, Costa Chica of Guerrero and Oaxaca.

Katherine Moreno-González¹, Ricardo Ramos-Rendón¹, Gabriel Mendoza-Medel¹, Heladio Moreno-Melo¹, Vicente Homero González-Álvarez^{1,*}

Abstract

Bovine brucellosis and tuberculosis are two diseases of great relevance in livestock farming, while in humans they are the predominant occupational diseases around the world. The objective of the study was to analyze the prevalence data of brucellosis and tuberculosis obtained between the months of February and September 2023. Eight bovine production units located within the Costa Chica region of Guerrero and Oaxaca were included. There were no positive cases in any of the herds. Through strategies for the control and eradication of brucellosis in animals and bovine tuberculosis, it has been possible to maintain a low prevalence of the disease in the national territory. It is suggested to carry out a study with more production units, include other risk factors, type of herd management and the use of other diagnostic techniques.

Key words: *Bos indicus*, *Brucella bovis*, *Mycobacterium tuberculosis*, Prevalence

Introduction

Since their domestication more than 10,000 years ago, cattle have been invaluable to the transition of human society from nomadic hunter-gatherers to sedentary agricultural communities (Pitt *et al.*, 2019). Currently, approximately 1.5 billion livestock are raised, in a variety of climatic zones and under diversified conditions, on all continents (Xia *et al.*, 2023). Due to

their impact on agricultural production, cattle have a higher status than other domestic animals in most cultures (Zhang *et al.*, 2020). Cattle could feed on local plants or forages, which can, in turn, be included as silage or hay (Wilkinson and Lee, 2018); in exchange, these animals provide meat, milk, leather and other products and by-products (Enahoro *et al.*, 2021).

¹Facultad de Medicina Veterinaria y Zootecnia No. 2, Universidad Autónoma de Guerrero, Carretera Acapulco-Pinotepa Nacional Km. 197. C.P. 41940, Cuajinicuilapa, Guerrero, México.

*homero.uagro@gmail.com



In rural areas of most of the Mexican national territory, livestock production is one of the most important activities. The country is among the top ten places in terms of meat and milk production worldwide (Rojo-Rubio *et al.*, 2009). In Mexico, specifically in the tropics, the bovine population is made up of Zebu cattle and their crosses; The cow-calf system is used based on extensive seasonal grazing and contributes 33% of beef production (Osorio-Arce and Segura-Correa, 2010). In 2022, the state of Guerrero had a total carcass meat production of 44,099.23 tons; where the municipality of Cuajinicuilapa participated with 1,217.79 tons of meat, ranking seventh in production (SAGADEGRO, 2023).

As in many other places, dual-purpose livestock farms in the tropics suffer from problems that require improvements in relation to animal health (Rangel *et al.*, 2020). Brucellosis is a bacterial disease with worldwide distribution, where livestock farming is an integral part. The etiological agent of bovine brucellosis is a gram-negative coccobacillus called *Brucella abortus* and, occasionally it can be caused by *Brucella melitensis*. Bovine brucellosis is called Bang's disease or contagious abortion, while human brucellosis is known as Malta fever or undulating fever (Khurana *et al.*, 2021). Bovine tuberculosis is a serious infectious zoonotic disease that affects humans and a wide range of domestic and

wild animals worldwide. The agents involved in the development of the disease are mainly the mycobacteria *Mycobacterium bovis* and *Mycobacterium tuberculosis* (Borham *et al.*, 2022).

In that sense, and especially in the case of Brucellosis and bovine Tuberculosis, there are the Mexico-United States Binational Committees, established in 1993, to specifically implement a comprehensive program for the eradication and control of the mentioned diseases (SENASICA, 2020; SENASICA, 2021; USDA, 2021). The highest level is the Advanced Modified Accredited, which is granted when in the region, the prevalence of tuberculosis is less than 0.01%, in this way, the export of animals is carried out without tuberculin testing (SAGARPA, 2006). In this sense, within the state of Guerrero, the municipality of Cuajinicuilapa is at the preparatory accredited level according to the USA category, which requires tuberculin testing of the mothers of the calves (the herd) and the batch to be mobilized (DGSA, 2020), with a prevalence of 0.39% in the herd, in the Eradication Phase under the Corresponding NOM in the Costa region (OSIAP, 2023). In relation to Brucellosis, the state of Guerrero has a Zone B zoosanitary status, as in the Eradication Phase within the framework of the National Campaign against Brucellosis (SENASICA, 2015). The

eradication zone is a geographical area with zoosanitary measures aimed at the total elimination of brucellosis, which could achieve zone status, if positive cases of brucellosis are eliminated or do not occur in the last 36 months (Lozano-López *et al.*, 2022). Therefore, the objective of the study was to analyze the prevalence datasheets of brucellosis and tuberculosis in cattle herds of the Costa Chica of Guerrero and Oaxaca.

Materials and Methods

The tests and results of the studies were obtained between the months of February and September 2023. The eight production units (PU) included in the study are located within the region called Costa Chica. As no animal management was done, approval from an ethics committee was not required. The mentioned territory begins at the eastern and southeastern limit of the municipality of Acapulco de Juárez and extends to the central coast of the state of Oaxaca (Quecha-Reyna, 2020; SPDR, 2021). Figure 1 shows the limits of the Costa Chica region and the location of the production units.

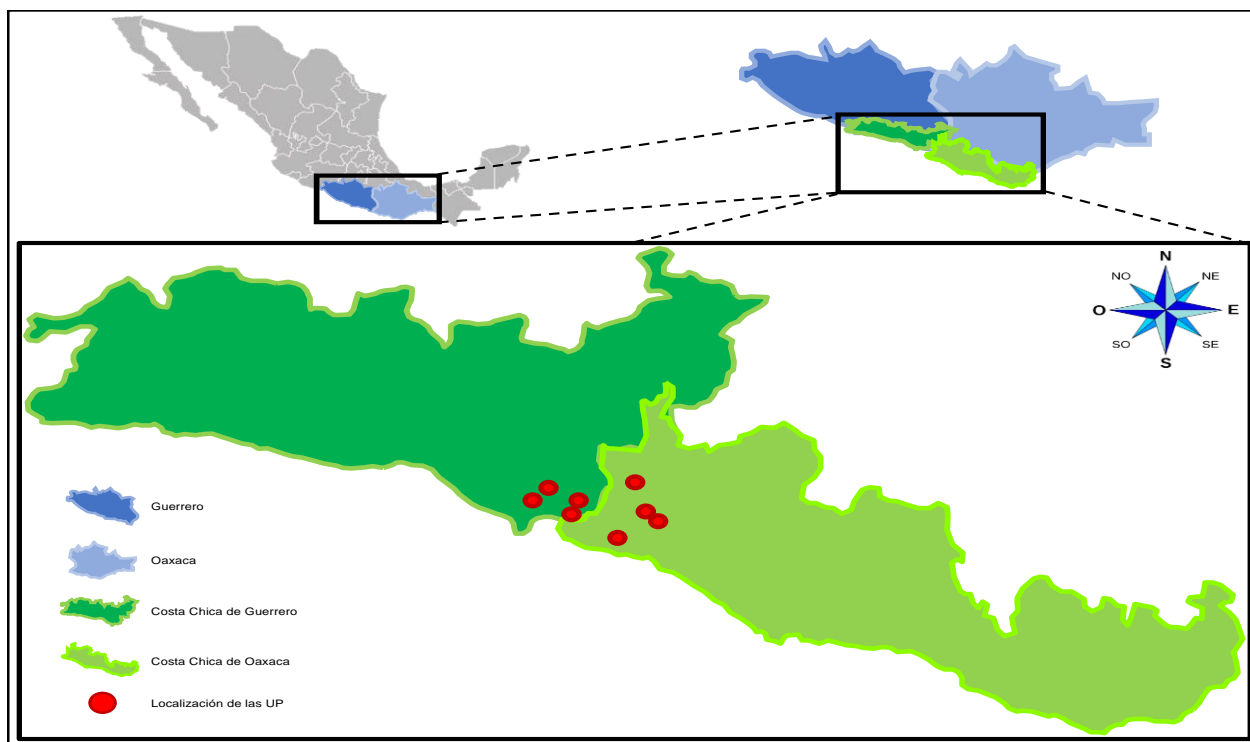


Figure 1. Location of sample collection sites.

The data correspond to the evaluation for the diagnosis of brucellosis and tuberculosis in cattle, carried out as part of

the campaign against brucellosis in animals and against bovine tuberculosis, by the Servicio Nacional de Sanidad,



Inocuidad y Calidad Agroalimentaria - Dirección General de Salud Animal (SENASICA). The diagnostic tests were performed by trained personnel and in accredited laboratories (NOM, 1995a), for the purposes in accordance with current regulations for the diagnosis of brucellosis and tuberculosis (NOM, 1995b; NOM, 1995c).

For the diagnosis of brucellosis, the 8% rose bengal test is used (Aba test, PRONABIVE, Mexico), and positive samples are confirmed with the rivanol test (Aba PRONABIVE test, Mexico); A sample is considered positive when titers result $\geq 1:50$ (Gutiérrez-Hernández *et al.*, 2020). The test for tuberculosis diagnosis is performed by intradermal injection of 1.0 mg of protein/ml of *M. bovis* in the tail fold. Using visual examination and palpation, the injection site is inspected approximately 72 hours later for indicators of immune response, such as swelling or discoloration, and the results are recorded. Seven days after interpretation, all cattle that had a positive reaction are tested again. For this, 0.5 mg of protein/ml of the *M. bovis* strain

and the *M. avium* strain are used, which are administered at the same time in 2 sites on the same side of the base of the neck. The results are interpreted after 72 hours, and based on the results the cattle are classified as negative or reactor; all reactors must be eliminated from the herd (Cisneros *et al.*, 2015).

Results and Discussion

The results of the tests carried out on a total of 432 cattle were used. There were no positive cases in any of the herds. A total of 221 females were evaluated, which represents 51.2% of the population, while 211 animals were evaluated for males, which represents 48.8% of the population. The racial stratum of the herd population was made up of three groups, two of pure breeds and a group of crossbreeds. The age of the animals ranged from 04 to 138 months, for an average of 79.1 months. Table 1 shows some particularities of the animals included in the study.

Table 1. Results of tests for the diagnosis of brucellosis and tuberculosis.

PUs	Breed	n	Rivanol test				Caudal fold test			
			♀	p	♂	p	♀	p	♂	p
1	CZ	94	0	0.0%	94	0.0%	0	0.0%	94	0.0%
2	CZ	80	0	0.0%	80	0.0%	0	0.0%	80	0.0%
3	GR	18	11	0.0%	7	0.0%	11	0.0%	7	0.0%
4	SN	20	0	0.0%	20	0.0%	0	0.0%	20	0.0%
5	CZ	19	17	0.0%	2	0.0%	17	0.0%	2	0.0%
6	CZ	15	13	0.0%	2	0.0%	13	0.0%	2	0.0%
7	CZ	147	143	0.0%	4	0.0%	143	0.0%	4	0.0%
8	CZ	39	37	0.0%	2	0.0%	36	0.0%	2	0.0%

Pus: Production Units; ♀: hembra; ♂: macho; p: prevalence; CB: cross breed, GR: Gyr, SN: Sardo Negro



In relation to brucellosis in cattle, Pérez-Ruano *et al.* (2022) processed 12,760 blood samples, of which 113 were positive, for a seroprevalence of 0.89%, in Cuba. In their study, Elemo and Geresu (2018) collected and examined a total of 768 sera, of which 76 were positive, for a seroprevalence of 6.1%, in Ethiopia. While Andrade-Guzmán *et al.* (2023) obtained 436 samples of which 37 were seropositive, obtaining a prevalence of 8.5%, in Ecuador. In the case of Madut *et al.* (2018), they examined a total of 893 serum samples, 277 were positive, for a seroprevalence of 31.0%, in Sudan.

According to data from the animal health campaign in the country, in the quarterly reports reported by the State Coordinators, corresponding to the period from January to September 2023, in which 3,059,847 tests have been carried out, and 3,081 animals were positive, for a national prevalence of 0.1%. The states of Baja California, Durango and Sonora reported zero positive cases, prevalence of 0.0%; while other states such as Jalisco, Tabasco and Chihuahua, report 676, 492 and 468 positive cases for a prevalence of 0.44%, 0.73% and 0.20%, respectively (DGSA, 2023).

In the case of bovine tuberculosis, Belete *et al.* (2021) found that 45 positive animals out of 497 cattle inspected, for a prevalence of 9.1% in Ethiopia. Kapalamula *et al.* (2023) observed that 154 of a total of 1,547 cattle examined were

positive, for a prevalence of 9.9%, in Malawi. Islam *et al.* (2020) estimated that 210 of 1,865 individuals were positive for bovine tuberculosis, for a prevalence of 11.3% in Bangladesh. Agbalaya *et al.* (2020) report that 48 of 187 sampled cattle, 25.7% tested positive for *M. bovis*, in Nigeria.

In Mexico, there is a study in which animals from several states were included; *M. bovis* was identified in 2,499 of a total of 10,818 suspicious samples, for a prevalence of 23.1% by bacterial culture. It is important to highlight that in the country there are states where the prevalence can be as low as 0.04%, such as Sonora or Tamaulipas, in beef cattle; but it can be increased, around 29.5% in the La Laguna Region or up to 41.2% in the state of Jalisco, in dairy cattle (Carrisoza-Urbina *et al.*, 2015).

Conclusion

The main limitation of this study is that it involves the presentation of the results of the analyzes carried out in a cross-sectional survey and only point prevalence estimates were obtained. It was not possible to include more production units due to the lack of willingness of the property owners, which also affects the true estimate of both diseases. It is suggested to carry out a study with more production units, possibly



using samples from animals sent to slaughterhouses, in addition to using other types of techniques such as the polymerase chain reaction.

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