CHAPTER I
INTRODUCTION

India holds great biodiversity in native domestic livestock, among them cattle and buffalo are integral part of Indian rural economy. India stands first in the world with regard to livestock population with around 58 percent cattle and buffaloes. India also ranks first in the world with regards to milk production. In India, total cattle population was 190.9 million out of total 512.5 million livestock population, which shares about 45 percent of total livestock population of the country. Total livestock population of Gujarat state was 9.98 million out of which 1.40 million heads were Gir animals in 2012 (Anon., 2013). India continued to be the largest milk producing country in 2013-14 with an estimated milk production of 137.6 million tonnes out of total milk production of world which was around 746.71 million tonnes so the country’s share in world milk production stands at 18 percent. The total milk production of Gujarat is 10.31 million tonnes which shares about 7.79 percent of total milk production of India (Anon., 2014).

Gir is well known high yielder milch breed of the country and originated from Gir forest and districts like Junagadh, Amreli, Bhavnagar, Gir-Somanth, Rajkot and Porbandar, some parts of Jamnagar, Morbi and Surendranagar districts of Gujarat. This breed is also known as Bhodali, Desan, Gujarati, Kathiawari and Sorthi. It was one of the contributor in the development of Brahman breed of North America. Gir animals are acknowledged for their tolerance to stress condition and resistance to various tropical diseases.

Various countries like Brazil, Mexico, USA and Venezuela have imported Gir animals where they are being bred successfully. The breed has also been exported to other parts of the world. In Brazil, where large herds are found it is known as 'Gyr'. Brazil has also evolved a strain called Indubrasil which is a cross between Gir and Kankrej. Gir has also been exported to USA especially to Texas, Florida and Lousiana states (Prabhakar and Singhal, 2006).

India has been richly and uniquely gifted with diverse bio-and-eco spheres that, in addition to supporting a huge and diverse livestock population, also contribute to the maintenance of variety of endemic bacterial, viral, fungal, parasitic and protozoan diseases. Cattle suffer from variety of disease condition that is infectious and non-infectious. Infectious diseases are caused by bacteria, parasites, fungi and viruses. Most
common haemoprotozoan diseases of cattle are trypanosomiasis, piroplasmosis, and theileriosis. Amongst haemoprotozoan diseases, Babesia is the second most common parasite found in the blood of mammals after trypanosomes (Yabsley and Shock, 2013).

Haemoprotozoan or tick-borne infections are most important in veterinary medicine which include Theileria spp., Babesia spp., Trypanosoma spp., Anaplasma spp. (Uilenberg, 2006). These hemoprotozoan infections are considered to be some of the major impediments in the health and productive performance of cattle (Rajput et al., 2005).

Babesiosis belongs to protozoan parasites of the genus Babesia, order Piroplasmida, phylum Apicomplexa and subclass Piroplasmsia and are commonly referred to as ‘piroplasmas’ due to the pear-like shaped merozoites which live as small parasites inside RBC of mammals (Hamsho et al., 2015). It was Victor Babes who at the end of the 19th century first discovered microorganisms in erythrocytes of cattle in Romania and associated them with bovine hemoglobinuria or red water fever (Babes, 1888). It is caused by multiple species but three species found most often in cattle are B. bovis, B. bigemina and B. divergens. Additional species that can infect cattle include B. major, B. ovata, B. occultans and B. jakimovi (Spickler et al., 2010). Two species, B. bigemina and B. bovis, have a considerable impact on cattle health and productivity in tropical and subtropical countries (El-Ashker et al., 2015). The disease is also known by such names as bovine babesiosis, piroplasmosis, Texas fever, redwater, tick fever and tristeza (Sahinduran, 2012).

Babesiosis is initiated by tick-borne transmission of the sporozoites, which subsequently invade host red blood cells in the infected animals. Tick vector of bovine babesiosis is Rhipicephalus (formerly Boophilus) spp. and Babesia bigemina transmitted by feeding of adult and nymphal stages of one-host Rhipicephalus spp. ticks. B. bovis transmitted by feeding of larval stages of one-host Rhipicephalus spp. ticks (Yadhav et al., 2015).

Among climatic factors, air temperature is the most important because of its effect on tick activity; higher temperatures increase its occurrence. Heaviest losses occur in marginal areas where the tick population is highly variable depending on the environmental conditions (Radostits et al., 2007).

Babesiosis is a haemolytic disease and characterized by fever (40-42°C) which may be sudden in onset, anemia, icterus, hemoglobinuria, listless, anorexic, jaundice and death (Demessie and Derso, 2015). Despite, being closely related and
transmitted by the same Boophilus ticks, *Babesia bovis* and *B. bigemina* cause remarkably different diseases in cattle (Simuunza, 2009). Strains vary considerably in pathogenicity; however, *B. bovis* is usually more virulent than *B. bigemina* or *B. divergens* (CFSPH, 2008).

Haematological analysis of cattle suffering from babesiosis indicated significant decrease in the mean level of RBCs, HCT%, Hb and platelets while increase in the values of MCV regardless of the method of detection. There was macrocytic hypocromic anaemia in the persistently infected animals (Mahmoud et al., 2015). Bovine infected with babesiosis revealed leukopenia, neutropenia and eosinopenia accompanied with lymphocytosis, monocytes and basophilia. Biochemical analysis revealed significant reduction in total protein, albumin, globulin, cholesterol, triglycerides and glucose levels associated with significant increase in the activities of liver enzymes (AST, ALT, alkaline phosphatase) and total bilirubin (Alam and Nasr, 2011).

Babesiosis is diagnosed based on the clinical evidence augmented with some parasitological or serological tests. Traditionally, the microscopic detection of *Babesia* parasites has always been considered as the gold standard for the diagnosis of acute babesiosis. However, the low sensitivity of the technique is the major drawback which makes it difficult to detect low parasitemia in the chronic stage of infection as well as in the carrier animals (Maharana et al., 2016).

Blood smears are not reliable for detection of carrier animals; hence, molecular detection methods or serological diagnostic procedures are required to demonstrate specific antibodies (Pohl, 2013). PCR can detect and differentiate *Babesia* spp, and is particularly useful in detecting carriers. Serology is not valuable in the clinical stage of the disease but is used for the purpose of research, epidemiological studies, export certification or where vaccine breakdown are suspected (Fincher et al., 2001.; Cynthia, 2005).

The first specific drug used against bovine babesiosis was trypan blue, which is a very effective compound against *B. bigemina* infections, however, it did not have any effect on *B. bovis* and it had the disadvantage of producing discoloration of animal’s flesh, so it is rarely used. For many years, the babesiacides: quinuronium sulfate, amicarbalide, diminazene aceturate and imidocarb diproprionate were used against bovine babesiosis. Diminazene aceturate is widely used in the tropics as both a babesiacide and a trypanocid (Mosqueda et al., 2012).
The purpose of conducting this research work is to expand the cattle health through diagnosis, haemato-biochemical analysis and clinical management of babesiosis in cattle population. The data generated by this research could further be used for planning of control and preventive measures of babesiosis in cattle population.

1.1 Objectives

1.1.1 To document the vector and record clinical picture of babesiosis in Gir animals.

1.1.2 To study the correlation among clinical, haematological and biochemical changes in *Babesia* infected Gir animals.

1.1.3 To evaluate therapeutic efficacy of medication in *Babesia* infected Gir animals.