CHAPTER - I

INTRODUCTION

Small ruminants are reared by the poorest sections of rural population with very small holdings. According to the 2012 census, the total sheep population in the country was 65.06 million and the goat population was 135.17 million. Since 2007, there has been a decline in sheep and goat population of 9.07 per cent and 3.82 per cent, respectively. Sheep rearing is predominantly migratory and managed by grazing on natural wastelands and by the semi intensive stable grazing in some areas. The average flock size is 5 - 15 in South India. Sheep and goat farming is a major source of livelihood for many poor farmers. These small ruminants provide an annual net return of about Rs. 250/- to its owner. However, these small ruminants directly impact the Indian economy by providing Rs. 66,109 million annually (Madan, 1996). However, diseases, especially parasitic diseases are the major constraint to the development of the small ruminant industry.

Sheep and goats, the specific small ruminants in this scenario, suffer from many diseases. The viral and bacterial diseases that affect these organisms are easily diagnosed by clinical signs. The parasitic infections are less in number either in early stages or without any clinical signs and thus act as one of the major cause of production loss. Faizal et al., 1999 reported growth retardation in small ruminants due to helminth infections. Herlich (1978) reported 5-10 per cent mortality and 10-20 per cent morbidity due to helminth parasites in small ruminants. The productivity of sheep and goats is constrained by parasitic infections (Dhar et al., 1982). Helminth infections remain one of the major constraints to small ruminant production in tropics (FAO, 1992). Surveys
indicated that up to 95 per cent of sheep and goats in the tropics are infected with helminths in which the main genera involved were *Haemonchus* and *Trichostrogyulus* (Rey, 1991). Mortality rate in herds may exceed 40 per cent with weight loss of 6-12 kg/year/animal. However, insidious productivity losses as the result of reduced feed intake and decreased efficiency in feed utilization, associated with subclinical or chronic conditions, are often the largest economic losses (Holmes, 1993; Gatongi, 1996). It is estimated that more than 300 species of helminthes parasitize the livestock in India with several new species being discovered frequently (Singh *et al*., 1977).

The incidence of helminth infection varies with age, sex, season and agro-climatic conditions. The infected animals have increased metabolic rate and reduced metabolic energy used for production. This is the result of parasites using their nutrients, damaging some vital organs and causing animals to become more susceptible to other pathogenic agents (Skykes *et al*., 1992).

The helminth species which parasitize small ruminants belong to three classes namely trematodes, cestodes and nematodes. The intensity of pathogenicity also varies between these helminth parasites. Small ruminants are a treasure house of different helminth parasites, such as *Paramphistomum* spp., *Fasciola* spp., *Dicrocoelium* spp., *Haemonchus* spp., *Trichuris* spp., *Chabertia* spp., *Dictyocaulus* spp., *Monezia* spp., and *Stilesia* spp. (Lone *et al*., 2012; Palanivel *et al*., 2012; Khajuria *et al*., 2013). Although many gastrointestinal nematodes (GINs) are responsible for parasitic gastroenteritis in small ruminants, *Haemonchus contortus* is considered to be the most prevalent and pathogenic nematode in sheep and goats, followed by *Trichostrongylus* spp., *Oesophagostomum* spp., *Bunostomum* spp.,
Cooperia spp. and Strongyloides spp. (Jeyathilakan et al., 2003; Easwaran 2004; Yadav et al., 2006). The importance of haemonchosis in domesticated ruminants was recognized as early as in 1938 (Sood, 1981).

Control of these GINs has rested firmly on the usage of anthelmintics for many decades. The practice of anthelmintic dosing at regular intervals in order to control GINs has led to the development of resistance in the parasitic population. When the nematode grows resistant to one anthelmintic, side- and cross- resistance occurs to other drugs with a similar mode of action, thereby placing serious restrictions on the use of anthelmintics (Arunachalam et al., 2005; Jaiswal et al., 2013).

Anthelmintic resistance in GINs has become a serious problem throughout the world in sheep and goats. In some countries, this resistance had become so alarming that it has resulted in the closure of livestock enterprises. As there is no obvious alternative to chemotherapy in order to control GIN populations, many farmers drenching the sheep and goats with anthelmintic drugs at frequent intervals. This leads to resistance, especially against benzimidazoles and imidazothiazoles in nematode populations of sheep and goats. The frequent use of anthelmintics in a resistant population of GINs may lead to an overall financial loss to the farmers (Chandrawathani et al., 2013; Rialch et al., 2013; Holm et al., 2014). Hence, it is essential to assess the efficacy of a broad spectrum of anthelmintics with appropriate and reliable methods to monitor and manage the anthelmintic resistance.

Anthelmintic resistance in nematodes of sheep and goats have been reported in several different states in India. (Singh et al., 1995; Srivastava et al., 1995; Gill, 1996; Swarnkar et al., 1999; Dhanalakshmi et al., 2003; Deepa and Devada, 2011;
Buttar et al., 2012; Jaiswal et al., 2013; Rajagopal et al., 2013; Rialch et al., 2013). Anthelmintic resistance against benzimidazoles in nematodes of sheep and goats in organized farms has been reported in Tamil Nadu (Gill, 1996; Jeyathilakan et al., 2003). However, very few surveys were conducted in Northwestern plains of Tamil Nadu (Arunachalam et al., 2005; Easwaran, 2004; Meenakshisundaram et al., 2014).

The growing importance of anthelmintic resistance in GINs has led to an increased demand for reliable and standardized detection methods (Coles et al., 1992). Most of the methods have drawbacks in terms of cost, applicability and interpretation (Varady and Corba, 1999). The most widely used method for detecting and monitoring the presence of anthelmintic resistance in nematodes is the faecal egg count reduction test (FECRT). This test is suitable for all types of anthelmintics, including those that undergo metabolism in the host. In addition, a number of in vitro assays viz., egg hatch assay (EHA) and larval development assay (LDA) are employed in order to detect anthelmintic resistance. However, these biological assays have certain shortcomings, as they are either relatively insensitive or laborious to apply.

In light of the above observations, the following investigation was undertaken to study the status of anthelmintic resistance in the small holder flocks using the standard techniques with the following objectives.

1. A survey on prevalence of gastrointestinal nematodes in sheep and goats of small holder flocks of Cuddalore district.
2. An evaluation of different anthelmintics against gastrointestinal nematodes by Faecal Egg Count Reduction Test using the McMaster Egg counting technique.

3. Detection of anthelmintic resistant benzimidazole in the field flocks through the use of various in vitro methods and faecal egg count reduction test.

4. Documentation of parasite control measures adopted by the sheep and goat farmers against parasitic infections of small ruminants.