Chapter 1

Introduction
1. INTRODUCTION

Livestock is emerging as the driving force in the growth of Indian economy. Contribution of livestock enterprise towards agricultural gross domestic product is 25%. Goat occupies an important place on rural economy because of its multifaceted role. On the basis of archeological evidence it is thought that the goat is first domesticated ruminant and stand second to be domesticated if considered both ruminant and non-ruminants. When man began his family operations in the dawn of history, the goat was the king-pin of the pastoral life, making possible the conquest of desert and mountain and the occupation of fertile land. Goats are potential source of meat, milk, skin, and fiber and are valued as laboratory as well as pet animal. In some parts of the country (like Bengal, Assam) people sacrifice goat to satisfy the God / Goddess. The wide range of utility combined with its docile, intelligent, graceful and frugal nature contributed to its earliest domestication. But with the advent of civilization, goats were surpassed by cattle, buffalo and sheep. The goat population is the fastest growing among the major ruminant species in spite of the fact that 41% goats are slaughtered and 15.5% of total goat population succumbs to natural death in the rural areas. The goat population is around 128 millions (Ranjan, 2003). Considering the annual rate of population growth (about 3.6%), with mean slaughter rate (41%) and mortality rate (15.5%), this small ruminant has achieved potential growth accounting 60.1% per year.

The importance of goat on the Indian agriculture is evidenced by its unparalleled economic traits, ability to get acclimatized under diversified agro
climatic situations, high fertility and short generation interval. From economic point of view, the goat is ideally suited for small and marginal farmers for the low cost maintenance, short-term return on capital with lower risk on capital investment. Goat thrives and contributes to rural economy even in areas where cattle and buffalo enterprises are difficult. These small ruminants are energetic, inquisitive and versatile in the art of food gathering. They have a greater tendency to change their diet with changing season than large ruminants. Semi-arid areas with sparse vegetation, bushes and shrubs can not support cattle but suit the browsing taste of goat.

Depending upon the adaptability to climatic conditions, the breeds differ in body conformation. Besides the several well defined breed of goats, certain local breeds are found in different agro-climatic zone. One of them is local breed of Bundelkhand characterized by black in colour, medium body size, Roman nose, long ear, thrive well on bushes and shrubs. Traditionally, this local breed has been a victim of neglect both by researchers and planners.

Individual microbial species that have developed in the rumen interact in a complex manner and cite some nature’s best examples of microbial symbiosis. Degradation and utilization of ingested plant bio-molecules is governed by plants, animal and microbial factors (Selinger et al., 1996). Effectiveness of the rumen microbial enzymes on plant nutrition is regulated largely by the physical characteristics of plants including structure, composition, feed processing etc. Mastication, salivation and rumination by the animal initiate release of nutrients from the plant material and increase their availability to microbial digestive
enzymes. Degradation and metabolism of the feed components (cellulose, hemicellulose, starch, protein, lipids) by rumen microorganisms supplies the carbon, energy, amino acids and vitamins required by the host animal.

A newborn kid is just like mono-gastric animals i.e. with simple undivided sterile stomach completely free from anaerobic microorganisms. But with the growth, the all four chambers viz, rumen, reticulum, omasum and abomasums developed and the former two are for the growth and multiplication of anaerobic bacteria, protozoa and fungi. The microbiota of rumen includes $10^{10} - 10^{12}$/ ml bacteria, $10^4 - 10^6$/ml protozoa (Hungate, 1966) and $10^3 - 10^4$/ ml fungi (Orpin, 1976) of rumen liquor. The discovery of rumen protozoa in 1843 by Gurby and Delaford was the first identification regarding the presence of microbes in alimentary tract of animals. The rumen is an unusual environment for microorganisms. It is warm ($39^0$C), has low redox potential and rich in particles such as starch, plant fibers, other plant bio-molecules. During feeding there are also injections of soluble compounds such as sugars and proteins (Selinger et al., 1996). Feedstuffs consumed by ruminants are all exposed to fermentative activity of anaerobic bacteria (Sinha and Ranganathan, 1983), protozoa (Misra et al., 1996) and fungi (Orpin, 1975, Samanta and Walli, 1999) prior to gastric digestion. Dietary plant complex polymeric nutrients viz. carbohydrate, protein, lipids etc. are generally degraded by the rumen microorganisms into characteristic end products which in turn provide nutrients for metabolism by the host. Fermentation of feedstuff in the rumen yields short chain volatile fatty acids (primarily acetic, propionic and butyric), carbon dioxide, methane and
ammonia. Ruminants use the organic acids and microbial protein as source of energy and protein produced by microbial fermentation. The quantity and quality of rumen fermentation product is dependent on the types and activities of the microorganism in the rumen. The anaerobic bacteria, protozoa and fungi constitute a significant portion of hydrolytic enzyme for fibrous food digestion of the host. The rumen, the most important segment of ruminant stomach provides a physical environment and a desired supply of nutrients to support an extremely diverse microbial community. The ruminant protozoa plays diverse and important role in the metabolism as these help in degradation of cell wall and other carbohydrate constituents by secreting digestive enzymes for digestion of polysaccharides (Williams and Coleman 1988). The bacteria are most abundant in the rumen. Bacteria hydrolyze plant carbohydrates into different volatile fatty acids, succinic acid, lactic acid and ethanol. The rumen fungi attack the feed both by physical and biochemical means (Akin et al., 1989). The physical disruption of plant fiber is performed by the penetration of rhizomycelial network of the anaerobic fungus and biochemical activities is attributed by the extensive array of fiber degrading enzymes including β-1,4 endoglucanase, β-1,4 exoglucanase, β-1,4 glucosidase, xylanase, pectinase etc. (Samanta and Walli, 1995). Thus anaerobic microbial degradation of feeds helps ruminants to utilize various types of vegetation for completing their nutrition requirements. The ruminant host provides congenial atmosphere for microbial growth and multiplication. Ruminant nutritionist and microbiologists have long been interested in manipulating the microbial ecosystem of the rumen
to enhance feedstuff utilization, improve production efficiency by ruminants and alleviate problems associated with current feeding practices (Lee et al., 2000). Dietary manipulation directed towards early development of ruminal functions helps to introduce fiber diet at the early ages (Sahoo et al., 2005). This can substantially save the milk for human consumption and reduce the cost of starter ration. In India, though goat keeping is predominantly done by small and marginal farmers, but several intensive goat enterprises are coming up at different parts of the country. Therefore, the date of establishment of different microbial communities in the foregut of kid alimentary tract will be of great useful for economic goat production. Moreover, determining the quantitative contribution of different microbes in adult goat rumen will enrich the existing knowledge of rumen microbial ecosystem. Under these circumstances the following objectives were outlined:

1. To see the time of establishment of various microbial communities in the rumen of local goat.
2. To determine the role of microbes on fermentative action of rumen.