

1. INTRODUCTION

Wine was believed to be made in the Caucasus and Mesopotamia as early as 6000 BC and the colonisation by the Romans spread wine-making all around the Mediterranean and eventually came to Northern India and China in 100 BC (Robinson, 1994; Pretorius, 2000). Alcoholic drinks have continued to be widely consumed in India since pre-Vedic times and specific reference to their consumption among the tribal people was mentioned in the *Ramayana* (300-75 BC) (Prakash, 1961).

Food fermentation is probably one of the oldest 'biotechnological processes' from which development of fermented foods and beverages, based on trial and error, has been rooted in cultural history of human being (Geisen and Holzapfel, 1996). Fermented foods and beverages are prepared by the action of microorganism(s), either spontaneously or by adding starter culture(s), which modify the substrates biochemically and organoleptically into edible products, and are thus generally palatable, safe and nutritious (Kwon, 1994; Campbell-Platt, 1994). Microorganisms bring about some biochemical changes in the substrates during fermentation such as enrichment of human diet with acceptable flavour, texture and aroma, biopreservation of food, bioenrichment of substrates with vitamins, protein and essential amino acids, and detoxification of undesirable components (Steinkraus, 1994; Stiles and Holzapfel, 1997). Filamentous fungi, yeasts and bacteria, mostly lactic acid bacteria constitute the microflora associated with the traditional fermented foods and beverages which are present in or on the ingredients, utensils, environment, and are selected through adaptation to the substrate (Hesseltine, 1983; Tamang, 1998). Making and use of fermented beverages are widespread interest enhancing the pleasure

of eating and have nutritional significance (Darby, 1979). Platt (1964) referred to traditional fermented beverage as primary example of “biological ennoblement” due to bio-enrichment with essential nutrients through fermentation.

Sikkim is a mountainous state of India with an area of 7096 sq. km and a population of 403,612 (Census of India, 1991a). The state comprises four districts→ North, East, South and West. Darjeeling, with an area of 3075 sq. km and a population of 13,35,618 (Census of India, 1991b) is a district of West Bengal in India. Excepting Siliguri, the three other subdivisions of this district including Darjeeling, Kalimpong and Kurseong are hilly, commonly known as the Darjeeling hills, inhabiting 70 % of the district population. Topographically, culturally and ethnically, people of the Darjeeling hills and Sikkim, comprising of mostly the ethnic Nepalis, the Bhutias and the Lepcha, have similarities. The Darjeeling hills and Sikkim are located in the Eastern Himalayan regions and are ecologically grouped as the Sikkim Himalayas.

The staple crop in the Sikkim Himalayas is maize (*Zea mays* L.) and other major cereal-crops are paddy (*Oryza sativa* L.), finger millet (*Eleusine coracana* Gaertn.), wheat (*Triticum aestivum* L.) and barley (*Hordeum vulgare* L.). Legumes including soybean [*Glycine max* (L.) Merrill] and black gram [*Vigna mungo* (L.) Hepper] are also grown.

A variety of indigenous fermented foods including dairy, cereal, vegetable, legumes, meat and alcoholic beverages are produced and consumed by the ethnic people of the Darjeeling hills and Sikkim for long centuries (Tamang *et al.*, 1988, Tamang, 2000). These foods are based on

socio-economic development status, religious and cultural practices, and have been evolved as the result of tradition and empirical experiences of generations over a period of time. Description of alcohol-drinking custom in the Sikkim Himalayas has been cited in some historical documents (Hooker, 1854, O'Malley, 1907; Risley, 1928). Indigenous fermented beverages constitute an integral part of dietary culture and have strong ritual importance among the ethnic people in the Sikkim Himalayas (Tamang *et al.*, 1996). Alcoholic beverages are exclusively prepared from locally grown cereal-grains using a starter called *marcha*. These alcoholic beverages are considered as nutritious. Traditional alcohol brewing is a home-based industry mostly done by rural women using their indigenous knowledge of alcohol fermentation.

Documentation on indigenous fermented beverages of the Sikkim Himalayas, information on microorganisms associated with these products, their role in fermentation, biochemical aspects of the various fermented beverages are not available. The proposed dissertation is aimed to study in depth the microbial diversity in indigenous fermented beverages, their role in fermentation, physico-chemical and enzymatic changes during fermentation. This will help to improve the commercial value of traditional fermented beverages, and also to preserve valuable microbial strains as genetic resources.

Objectives:

- ◆ To assess the traditional processing and utilization of available starchy substrates; equipment uses; consumption pattern; socio-economy and ethnical importance.
- ◆ To determine proximate composition of the products before and after fermentation.
- ◆ To isolate and to characterize the dominant microorganisms from the samples collected from different places in order to identify their taxonomical status, and to analyse viable cell counts.
- ◆ To study the succession during fermentation: microbial, physico-chemical and enzymatic activities.
- ◆ To select strain(s) isolated from marcha collected from different places on the basis of amylolytic activities for improving traditional starter with desirable microorganism(s).
- ◆ To evaluate the sensory properties of fermented beverages prepared by using selected strain(s).