CHAPTER 1

INTRODUCTION

Plants have been proven to play a remarkable role as food in human life. Most of the edible plants were domesticated from wild ancestors long before of recorded history [History of plant foods, 2015]. Wild plants play an important role in community nutrition and it is used in preparation of most of the traditional recipes [Deb *et al.,* 2013]. They also have a proven track record to be most useful in treatment of diseases worldwide with minimal cost and side effects [Yabesh *et al.,* 2014]. Edible plants serve the purpose of food during scarcity due to its availability throughout the year [Guy and Francois, 2003; Ogle *et al.,* 2003].

Indian subcontinent is inhabited by over 53.8 million tribal population in about 5000 forest dominated villages of tribal community and comprising 15% of the total geographical area of Indian landmasses, representing one of the greatest emporia of ethno-botanical wealth [Ciba Foundation Symposium 185, 1994].

North-eastern states of India have a rich flora of medicinally important plants which are consumed as ethnomedicine not only by local tribes but also by urban population [Jadeja *et al.,* 2012]. Assam, with diverse ethnic communities and socio-cultural complexities, has maintained one of the oldest and most diverse traditions associated with the use of ethnomedicinal plants [Borah *et al.,* 2009]. Dibrugarh district of Assam embraces a large number of ethnomedicinal plants which are used by the natives as food or in treatment of diseases or both [Bhuyan, 2015].

There is a class of wild plants knows as Rattan, of which some are edible and used as an ingredient in many delicious and nutritious dishes, and also as traditional medicine

[Boonsermsuk *et al.,* 2007]. The reported edible varieties of Rattans include *Calamus tenuis* Roxb., *Calamus javensis, Calamus siamensis, Calamus viminalis, Daemonorops schmidtiana, Plectocomiopsis geminiflorus* [Boonsermsuk et al, 2007], *Calamus ornatus* [Gracia *et al.,* 2008] and *Calamus leptospadix* [Uddin *et al.,* 2013]. There are over 70 species of Rattan reported from India till date [Shaanker *et al.,* 2004]. Its edible fruits [Durst *et al.,* 1994] and tender shoots [Manohara, 2013] are consumed as functional food or as dietary supplement in South-East Asian countries due to their rich proteins, carbohydrates, minerals and fibre content and reported therapeutic potentials [Dransfield *et al.,* 2002; Manohara, 2013].

The *Calamus tenuis* Roxb. belonging to the wild edible category of Rattan is extensively used worldwide. It is found in Bangladesh, Bhutan, Northern and North-Eastern India (West Bengal, Bihar, Uttarakhand, Uttar Pradesh, Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura), Laos, Nepal, Myanmar, Thailand and Vietnam; mostly on lowland rainforest in swampy or flooded area along river margins to 300 m elevation and often cultivated or persist near villages. *Calamus tenuis* Roxb. of Arecaceae family is commonly known as Jati Bet (India), Bet (Bangladesh), Wai nyair (Laos), Kyien dui (Myanmar), Pani Bet (Nepal), Wai khom (Thailand), May dang (Vietnam) and is an important ethnomedicinal plant [Henderson, 2009].

Several surveys have been conducted on wild plants in various parts of India for their utilization as food [Sajem and Gosai, 2006; Sasi and Rajendran, 2012; Pfoze *et al.,* 2012]. In recent years, ethnic knowledge has been increasingly studied to identify the use of indigenous plants with high nutritional, medical and/or commercial potentials to contribute for improvement of livelihood. [Dembele *et al.,* 2015]. Studies have shown that the uses of medicinal plants are linked to factors like education,

knowledge, health, cultural issue, environment, rural and urban population [World Bank, 2001]. A study conducted by Srithi *et al.* (2009) found that the plant use is decreasing with the increase of formal education. Alencar *et al.* (2014) reported that occupation was an important factor in the knowledge and uses of medicinal plants. According to Tabuti *et al.* (2002) opportunities for income in local communities play an important role in motivation for the conservation of local species of plants. In a study, Bortolotto *et al.* (2015) found that the communities away from urban area retained more knowledge about uses and practice of indigenous plants. The ethnic communities of North East India have immense knowledge on utilization of wild plants [Sundryal *et al.,* 1998] and shoots of *Calamus tenuis* Roxb. is traditionally believed to be used by the natives in this region including Dibrugarh district of Assam, in the forms of vegetable and for treating certain diseases, and there was no report available on its consumption pattern, traditional therapeutic practices, health issues beliefs, storage and sources. Therefore, to conserve the ethnic information regarding traditional practices, therapeutic knowledge and uses of *Calamus tenuis* Roxb. shoots, the present study included a survey for documentation of the same.

Among various diseases, cancer has become a big threat to human beings globally. Based on the GLOBOCAN report (2011), about 12.7 million cancer cases and 7.6 million cancer deaths was estimated in 2008. Cancer survival tends to be poorer in many countries, most likely due to combination of late diagnosis and limited access to timely and standard treatment [Jemal *et al.,* 2011].

As per estimate of WHO (2014), 14.1 million new cancer cases occurred in 2012. Lung, female breast, colorectal and stomach cancer was accounted for more than 40% of all cases diagnosed worldwide. In men, lung cancer was the most common cancer

(16.7% of all new cases in men). Breast cancer was the most common cancer diagnosed in women (25.2% of all new cases in women).

At the end of 2012, prevalence of cancer was found to be 32.5 million within the last five years. In women, breast cancer was common with 6.3 million cases and 3.9 million prostate cancers in men. Colorectal cancer prevalence was 3.5 million in men and women altogether [WHO, 2014].

Cancer is one of the leading causes of death worldwide. 8.2 million deaths occurred in 2012. More than half of all cancer death each year is due to lung, stomach, liver, colorectal and female breast cancers [WHO, 2014].

If recent trends in major cancers are seen globally in the future, the burden of cancer will increase upto 23.6 million new cases each year by 2030 [WHO, 2014].

As per Indian population census data (2011), the rate of mortality due to cancer in India was high and alarming with about 0.81 million existing cases by the end of the last century. Cancer is the second most common disease in India responsible for maximum mortality with about 0.3 million deaths per year. This is owing to the poor availability of prevention, diagnosis and treatment of the disease. All types of cancers have been reported in Indian population including the cancers of skin, lungs, breast, rectum, stomach, prostate, liver, cervix, esophagus, bladder, blood, mouth, etc. The causes of such high incidence rates of these cancers may be both internal (genetic, mutations, hormonal, poor immune conditions) and external or environmental factors (food habits, industrialization, over growth of population, social etc.) [Ali *et al.*, 2011].

Undergoing treatment for cancer automatically leads to disastrous side-effects caused by chemotherapy and radiotherapy. Severity of side effects may vary from person to person depending upon the types of treatment undergoing and drug category. The side effects may be of wide range like- nausea and vomiting, hair loss, infection, blood clotting problem, diarrhea, nerve and muscle effects, effects on skin and nails, kidney and bladder effects, physical and psychological, mouth, gum, and throat problems, which greatly affect the lifestyle of the person [The Cancer Society of India, 2014].

Therefore, it has been a serious burden and challenge for the population to fight cancer at present and in future, which demand to look for an alternative approach of treatment having less or no side effect.

Herbal medicine remains one of the common forms of therapy available for most of the world's population. According to WHO, about three-quarter of the world's population currently uses herbs and other forms of traditional medicine to treat diseases [Si-Yuan *et al.,* 2014]. Ethnobotanical and ethnopharmacological research play a crucial role in development of drugs from natural sources. The information obtained on identification, preparation, clinical use, gathering, and preservation of medicinal plants dramatically facilitates the search for new drugs [Farnsworth and Soejarto, 1985; Soejarto and Farnsworth, 1989]. Medicinal plants and its ethnic knowledge about their therapeutic uses serve as a raw material for such research. Besides other indigenous plants, there are some *Calamus sp*. which are reported to have some therapeutic activities. *Calamus quiquesetinervius* are known to have antioxidant, anti-inflammatory and anti-platelet aggregation activities [Chang *et al.,* 2010]. *Calamus leptospadix* Griff. have shown anthelmintic potential [Borah *et al.,* 2013]. *Calamus insignis* was reported to be cytotoxic and exhibit cell growth inhibition to HeLa Cells [Takashi *et al.,* 2006]. Gracia *et al.* (2008) found that

phytoconstituents of tender shoots of *Calamus ornatus* reduced cell proliferation of breast (MCF-7), central nervous system (SF-268), lung (NCI-H460), colon (HCT-116) and gastric (AGS) cancer cell lines and also stated that inclusion of rattan-shoots in diet may help in preventing inflammation and cancer-related illnesses. Use of *Calamus tenuis* Roxb. shoot as vegetables was reported to be beneficial in diarrhea, edema and intrinsic hemorrhage [Uddin *et al.,* 2013]. Extract of *Calamus tenuis* Roxb. fruits have shown analgesic [Hossain, 2013], antioxidant and cytotoxic activity, and are rich in alkaloid, flavonoids, tannin and steroid [Ahmed *et al.*, 2014]. In other *Calamus* species, phytochemicals like alkaloids, carbohydrates, fats, glycosides, lignin, steroids, saponins, triterpenoids, tannins and flavonoids are reported in *Calamus leptospadix* Griff. [Borah *et al.,* 2013], and steroidal saponins in *Calamus insignis* [Takashi *et al.,* 2006] and *Calamus ornatus* [Gracia *et al.,* 2008].

As per laboratory and epidemiological researches, whole edible plants or their active components like flavonoid, tannin, volatile oil, glycoside, alkaloids, etc. have substantial and protective effect on human carcinogenesis [Greenwald, 2002; Tsao *et al.*, 2004; Metha and Pezzuto, 2002]. However, scientific evidence about phytoconstituents and cytotoxic potential of *Calamus tenuis* Roxb. edible shoots is not available; therefore it was important to conduct the phytoconstituents screening and to assess cytotoxicity potential of *Calamus tenuis* Roxb. shoots through a series of relevant protocols on cancer and normal cells for evaluating its anti-cancer potential.