CHAPTER – 1:

INTRODUCTION

1. INTRODUCTION

Wild edible plants are used to be one of the commonest food sources for mankind from the time immemorial. Utilization of the wild edible plants as a source of food and medicine is an integral part of the culture of the indigenous people throughout the world. Till date, the agricultural societies did not eliminate the use of non-cultivated resources. Though most of the plant foods for human consumption is based on rather limited number of crops (12 crops contribute more than 85–90% of worlds caloric intake), the use of wild plants are not negligible rather increasing in many parts of the world (Misra et al., 2008). These plants are used as the substitutes and fill the gap of food deficiency.

It was estimated that though a total of 82 species commodities, or 103 species taxonomically, contribute 90% of supplies of food plants in the world (Prescott-Allen & Prescott-Allen, 1990), the usage of wild plant is still a tradition that has survived in many local communities (Turner, 2011). Researchers have emphasized on the diversity and value of traditional vegetables (Misra et al., 2008). Some studies indicated that the nutritional values of traditional leafy vegetables are higher than several known common vegetables (Sundriyal & Sundriyal, 2001; Nordeide et al., 1996; Shackleton et al., 1998; Orech et al., 2007). Most of these traditional leafy vegetables have a potential for income generation but fail to compete with exotic vegetables at present due to the lack of awareness (Misra et al., 2008). Consumption of traditional vegetables has been reported to have many beneficial effects such as prevention of some age related degenerative diseases – arteriosclerosis, stroke, etc. (Lindeberg et al., 2003). According to the several reports, wild green leafy vegetables increase the amount of blood in the body which is likely to be due to the high iron content in them (Misra et al., 2008).

Apart from the beneficial effects, several natural toxins may also be present in these wild edible plants as a result of natural selection and new breeding methods that enhance these protective mechanisms (Risk Assessment Section, 2007). It is noted that information on the possible toxic effects of most of the wild edible plants is little. Therefore, the information

documented on nutritional values and possible side effects of these plants are highly required to make the people aware about the hazardous effects of the consumption of these plants.

Ferns are one of the most widely used wild edible groups of plants throughout the world. Ferns provide food, medicine, fiber, crafts and building material, abrasives and decoration. Ferns constitute the primitive vascular plant group which is found scattered all over the world. Since medicinal uses of some ferns of India were well described, much research works have been done in the field of ethnobotany (Sen & Ghosh, 2011). But very few studies have been done so far on the pharmacological activities of this group of plant.

Since ferns and fern allies have survived from Paleozoic times, they have adapted with many more various changes of environment than the other primitive vascular plants (Wallace et al. 1991). Therefore, ferns are expected to have many useful phytochemicals than other plants. Ferns were reported to have many useful phytochemicals such as flavonoids, steroids, alkaloids, phenols, triterpenoid compounds, varieties of amino acids and fatty acids (Zeng-fu et al., 2008). It is interesting to note that not all the ferns are edible and only a few of them are used as food throughout the world. Edible ferns are some of the most common wild food plants collected by people around the world. The fern stems, rhizomes, leaves, young fronds and shoots, and sometimes the whole plants are used for food (Liu et al., 2012). In recent years, more and more researches have reported the food and ethnomedicinal uses of ferns in different parts of the world but very few studies have been conducted so far to assess the pharmacological/ toxicological impact of this group of plant on human health. If we take the example of bracken fern (*Pteridium aquilinum* var. *latiusculum*), it is observed that bracken fiddleheads are considered as a nutritionally rich food in Korea. They contain significant amounts of protein, fiber, vitamins, and minerals. However in many countries, brackens are known as poisoning plants because of their carcinogenic and antithiamin properties. The carcinogenic substance of bracken is ptaquiloside (Hirono et al. 1984). Ptaquiloside is very carcinogenic in mammals, especially ruminants, which repetitively ingest huge amounts of bracken, and may be very harmful to humans if large and repetitive doses of bracken are taken (Ham, 2004).

Apart from the bracken fern, *Diplazium esculentum* (Koenig ex Retz.) Sw. (Family – Athyriaceae) is one of the most commonly consumed non-bracken edible ferns throughout the

world. Some of the studies have been performed so far to assess the antioxidant, antimicrobial, antitumor or other beneficial activities of this fern (Nanasombat & Teckchuen, 2009; Tongco et al., 2014; Kaushik et al., 2012; Seal, 2013) but very few studies have been performed so far to determine the possible pharmacological and toxicological impacts of this fern on human and animal health. Study conducted on rabbits and guinea pigs demonstrated systemic toxicity and several pathological effects of this fern. Young fronds of *D. esculentum* collected from the high-altitude area of Harsil–Gangotri of Northern India were found to have moderate level of ptaquiloside (Pta), a nor-sesquiterpenoid glycoside which is clastogenic, mutagenic and carcinogenic that cause enzootic bovine hematuria in hill cattle in India and elsewhere (Somvanshi et al., 2006). A moderate amount of Pta was also found in *D. esculentum* sample that was prepared by freeze drying and shade drying methods (Somvanshi et al., 2006). Moreover, Pta rich frozen- and shade-dried crude *D. esculentum* have already been shown to cause poor growth, decreased body weight, increased spontaneous (vertical and horizontal) and decreased forced motor activity, alterations in values of blood glucose, erythrocyte sedimentation rate, mean corpuscular volume, mean corpuscular hemoglobin, total leukocyte count, neutrophil, lymphocyte and monocyte count, and increased blood SGOT level in both rats and guinea pigs (Gangwar, 2004). Pta is considered as the causative agent for the location of tumors in the urinary bladder of ruminants and the ileum of rats (Smith et al., 1994).

It is observed that this fern grows abundantly in the marshy land and also in the wet shabby places where lot of insects are available. But interestingly, insects consuming the leafy portion of this fern have never been found. Leaves are all intact, not consumed by any insect and even cattle. We also observed that the Rajbanshi population, the original inhabitants of this region, consumes this fern regularly after cooking. It seemed that they are aging at a much faster rate as they looked much older than that of their actual age. As we did not get convincing data regarding the toxicity of this fern (if any) to human, we performed the experiments using inbred strains of mouse as an animal model to establish the immunopharmacological as well as toxicological basis of this edible fern.

Since early days, local people were consuming the unmodified plant parts (coiled frond and young leaf) or boiling the plant materials of *D. esculentum* in water. But, sometimes, even

boiling may not completely destroy the toxic materials that are harmful to the body. Therefore, the present study on the pharmacological properties of this wild edible fern may serve as a baseline data for the future studies on the nutritional values and possible side effect of this plant in the study area and elsewhere.