

Preface

Plants have been a source of oxygen and food for birds, reptiles, insects, microbes and animals including human beings. In addition, plants have also sheltered them from extreme weather. For human beings, they have provided raw materials for clothing and housing. Apart from these, human beings have always turned to plants for curing their ailments. Though many antibiotics have been discovered from microorganisms beginning last century, the microbes were unknown to humans until Antonie van Leeuwenhoek invented microscope in the second half of the seventeenth century. Hence, it was obvious for them to use plants for their various needs as they were conspicuous and easily available. In the process, human beings living in different parts of the world independently developed traditional knowledge about the use of local plant resources for their daily needs as well as for treating diseases. This indigenous medical knowledge along with all other acquired knowledge was passed on from one generation to another, often through oral transmission. Few civilizations also documented their medical practices leaving behind a treasure-trove of knowledge. Some of these include Ayurvedic medicine, Unani medicine, Traditional Chinese medicine, Traditional Tibetan medicine, Egyptian medicine, Greek medicine and Roman medicine. We now know that the healing properties of the medicines used by these civilizations were primarily due to plant secondary metabolites. Once considered as waste, plant secondary metabolites have now been known to play important roles in the adaptation and survival of plants.

Many plant derived secondary metabolites are used in modern medicine while large portion of the world population still depend on traditional medicinal plants for treating their diseases by local healers. Apart from the medicinal uses, these secondary metabolites have also been used as food, food and health supplements, beverages, perfumes, dyes, etc.

Ginseng is one such plant that has been in use in Chinese traditional medicine for over two thousand years for treating various ailments like anorexia, insomnia, hemorrhage, diabetes, impotence and palpitation. We now know that ginsenosides, which are triterpenoids, are the bioactive principles of Ginseng plant. Ginseng belongs to genus *Panax* which contains several species like *P. ginseng*, *P. notoginseng*, *P. quinquefolius*, *P. japonicus*, *P. vietnamensis*, *P. bipinnatifidus*, *P. sokpayensis*, etc. *P. sokpayensis* was recently reported from the Sikkim Himalaya in 2009. Since indigenous people use this species in herbal medicines, we thought that like other species of *Panax*, this newly reported species must also contain ginsenosides. Hence, studies were undertaken to find the

ginsenosides profile of this plant and also to clone and characterize the ginsenoside biosynthetic pathway genes. The work presented in this thesis was started in 2012 and is the first to generate genomic data on this species which would hopefully pave the way for further research on this economically important species. We have also successfully detected some of the major ginsenosides in *P. sokpayensis* rhizome.

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