Chapter 6

CONCLUSION

Rheum is a perennial herb generally found at higher altitudes and is medicinally important plant due to the presence of diverse anti-microbial, anti-inflammatory, purgative, laxative properties. In this study, phytochemical analysis was conducted to determine the presence of specific metabolites in nine different populations. Additionally, the genetic variability within and among these populations was assessed. The qualitative screening of leaf extracts from *Rheum emodi* was performed, and the total phenols content was estimated using TLC and a standard curve. The findings of the phytochemical screening indicated that the leaves contain metabolites that play a role in various protective mechanisms in vivo. Mostly all the secondary metabolites like phenols, tannins, saponins, terpenoids and steroids, fatty acid-derived substances and polyketides, alkaloids were present in the samples. The maximum phenolic content was found in chloroform variant of Tungnath. Hence we can also conclude that plants growing in high altitude regions have been found to contain higher levels of phytochemical compounds compared to those growing at lower altitudes. This is due to the harsh environmental conditions, such as low oxygen levels, cold temperatures, and intense ultraviolet radiation, which the plants have to adapt to survive. Therefore, plants growing in high altitude regions have evolved to produce higher amounts of phytochemical compounds as a survival strategy, placing them as a valuable reservoir of natural antioxidants, offering potential health advantages to humans. To establish the significance of specific phytochemical constituents with protective action, further investigations involving pharmacological activities and additional biochemical assays are required. These studies would help to validate the importance of these constituents and their potential benefits in various biological contexts.

Rheum species is native to the high altitude regions have been found to possess significant antimicrobial activity. In the present study the different variants of leaf extracts of *Rheum* have shown to possess antimicrobial activity. *Rheum emodi* has been discovered to possess significant levels of essential oils, including thymol, eucalyptol, and carvacrol. These essential oils have exhibited strong antimicrobial characteristics, effectively targeting a wide range of microorganisms, including bacteria, fungi, and viruses. Additionally, the presence of high levels

of flavonoids and phenolic compounds in these plants has also been linked to their antimicrobial activity. Overall, *Rheum* is a plant that contains a wide range of phytochemicals, including anthraquinone, flavonoids, tannins, and phenolic compounds. These bioactive compounds have been shown to exhibit potent pharmacological activities, including anti-inflammatory, antioxidant, and anticancer properties. Research has indicated that *Rheum* species contain anthraquinone, including aloe-emodin and emodin, chrysaphanol, physcion, and rhein, possess significant anticancer activity against various types of cancer cells. Moreover, the flavonoids and phenolic compounds in *Rheum* have been found to possess antioxidant and anti-inflammatory activities, which can aid in prevention against the development of chronic diseases such as diabetes and cardiovascular diseases. Hence, the phytochemical compounds present in *Rheum* hold immense promise as a valuable resource for developing novel medications to address a wide range of ailments. Expanding research in this field has the potential to unveil potent therapeutic agents with significant clinical applications.

The current research has provided insights into the factors contributing to polymorphism, which can aid in the development of better plant conservation strategies. The findings suggest that genetic diversity analysis can be valuable in facilitating breeders to improve the quality of plants. The study recommends the use of RAPD marker analysis for examining genetic variability among closely related genotypes, as this method is more appropriate. Additionally, the study's use of RAPD markers has proven effective in distinguishing between *Rheum emodi* populations from nine different altitudes, highlighting the genetic diversity of the species in the Indian Himalayan region. Overall, the study emphasizes the high genetic diversity of *Rheum emodi* in this region, which could be crucial information for future conservation and breeding efforts.

Inter-Simple Sequence Repeat (ISSR) markers are employed for the assessment of genetic variability present within and between populations of organisms. ISSRs are PCR-based markers that amplify the regions between two simple sequence repeat (SSR) motifs using primers that are designed to bind to these motifs. This study has shown that ISSR is an effective tool for molecularly characterizing *Rheum* species between populations. The ISSR technique offers several advantages, including the ability to analyse multiple loci, its high reproducibility, simplicity, and cost-effectiveness. These features make it an appealing method for exploring genetic variations and population genetics. The results of ISSR analysis provide valuable insights into the genetic

distances between different landraces of *Rheum.* This knowledge can be instrumental for breeders in utilizing genetic resources more effectively to enhance the species and develop new varieties, while taking into account the genetic differences among *Rheum* landraces.

In conclusion, using DNA to identify species has many advantages for scientists, educators, and the public. It can greatly enhance our understanding of biology and increase interest in conservation and evolution. The ability to use DNA to identify various plant species and to isolate small amounts of DNA for PCR-based analysis, presents a unique opportunity to yield useful information in breeding aspects or deciding germplasm improvement strategy of this species, particularly to exclude populations, which might have very low variability due to a large period of traditional use. The present study also yielded valuable information regarding the diversity and variability within and among the populations/provenances of plants and assisted in locating the spot of diversity in the entire zone of distribution of *Rheum sp*. in Western Himalayas (Uttarakhand), As a result, the utilization of ISSR markers aids in determining in-situ and ex-situ conservation priorities. By assessing the genetic variability among populations of *Rheum,* conservation efforts can be strategically focused on preserving and protecting the most diverse and genetically distinct populations. This information is crucial for implementing effective conservation strategies and ensuring the long-term survival and genetic diversity of the species.