CHAPTER 7 – SUMMARY AND CONCLUSION

The tropical forests of Western Ghats are constantly under the pressures from the unending increase in anthropogenic factors at various scales. The large scale forest fragmentations, loss of canopy cover and shift in the microclimatic regime of the habitats is proving to be catastrophic to the already threatened biodiversity in the region. Though the importance of flowering plant diversity as a key component of the terrestrial flora of Western Ghats is well established, still there lies a huge lacuna in our existing knowledge on lower plant groups. Among these, the pteridophytes, which are ancestors of the terrestrial flora, are totally dependent upon the hydrology of these forests and extremely sensitive to microclimatic changes. In the current study, it is well evident that some important forest patches in the form of sacred groves and *Myristica* swamps continue to harbor perennial ferns including the endemic species – *Cyathea nilgirensis*, *Bolbitis subcrenatoïdes*, *B. semicordata* and *Osmunda huegeliana*. Besides, the occurrence of 76 species of pteridophytes belonging to 40 genera and 28 families in the wet forests of Uttara Kannada and Hassan district indicate the presence of some important tropical moist forest habitats which need to be conserved for maintenance and betterment of the pteridophyte flora in long run. The hydrological based affinities of these species in this study are helpful in delineating the specific habitat niche harboring perennial fern species and species of high conservation value.

The other important lower plant group of terrestrial flora – lichens is of prime importance as its occurrence is known far and wide from the tropics to the poles. Its ecological indicator value has been justified in several studies and the current study too fortifies that by enumerating and analyzing the distribution of 133 species of lichens from 16 different habitats represented by different forest types and varied degree of anthropogenic factors. The transition of lichen growth
forms from primitive microlichens to macrolichens as one moves from closed canopy wet forests to open canopy and highly disturbed dry forests is clearly evident from this study. Interestingly, this observation is in stark contrast to couple of other studies which have demonstrated the good growth of macrolichens in core region of moist forests as in the central Western Ghats, these macrolichens demonstrated good growth on open canopy vegetation as well as forest exteriors. However, the role of ecological indicator families such as Thelotremataceae, Graphidaceae (preferring humid and shaded forests); Parmeliaceae and Physciaceae (highly photophilic and disturbance tolerant species), Pertusariaceae (fire tolerant), Cyanophyceae (high humidity and moisture loving lichens) can be seen as true for the forests of central Western Ghats.

Over a period of time the forests of central Western Ghats have been subjected to human-induced disturbances such as encroachments, illegal logging and collection of Non Timber Forest Products (NTFPs), grazing of animals, exploiting the perennial water resources, fire occurrences (in drier regions) and a substantial increase in number of tourists/pilgrims leading to waste generation. These factors have already led to changes in the existing forest cover and types in the region and if left unchecked, would prove to be disastrous for the species with narrow habitat niche in the region. The uniqueness of the forests of central Western Ghats can be adjudged from the fact that with these varied degree of factors, they harbor unique lichen and pteridophyte vegetation which further strengthens the need for conservation of different habitat types to maintain these species. The study sites in the region with low to moderate disturbance values provide a good scope of maintaining this uniqueness by simply managing their habitats and its surrounding areas. Whereas, the highly disturbed sites need crucial long term improvement strategies with some strict management plans.
For *in situ* conservation of pteridophytes and lichens, it is crucial to identify areas with higher species diversity and higher percentage of threatened species. Such areas can be protected by bringing them under the legal protection network in the form of ‘Conservation Reserves’ of ‘Biological Heritage Sites’. Besides, the buffer zone of such areas can be developed with the native vegetation to ensure larger habitat availability for the cryptogams to proliferate and expand their population in nature. Along with this, the *ex situ* conservation strategies such as developing ferneries including native fern species, preserving species in the form of herbarium resources and spore banks and developing *in vitro* techniques for successful development of the species in lab conditions are some of the key conservation strategies. However, all these strategies will be more fruitful by roping in the various stakeholders of society to participate in the conservation programs through awareness activities such as database development, publishing popular articles and delivering popular lectures, interactions with the local people, forest department officials, etc. The collective efforts of all these strategies together will ensure successful conservation of pteridophytes and lichens in central Western Ghats as well as other species rich ecosystems too.

The current study was able to contribute to the science in following ways:

1. Enumerating 133 species of lichens from central Western Ghats of Uttara Kannada and Shimoga districts. This included the record of four species – *Opegrapha robusta, Pertusaria mesotropa, Ocellularia cruentata* and *Coenogonium leprieurii* as new additions for the lichen flora of India.

2. Record of 14 lichen species - *Bacidia subannexa, Chrysothrix chlorina, Enterographa pallidella, Graphis caesiella, Graphis handelli, Hemithecium lamii, Hemithecium scariosum, Pertusaria coccodes, Pyrenula mastophoriza, Pyrenula quassiaecola,*
*Heterodermia hypochraea, Pyxine consocians, Ramalina hossei* and *Usnea pseudomontis-fuji* as new additions to the lichen flora of Western Ghats.

3. Record of 25 lichen species as new additions to the lichen flora of Karnataka state. A special record of *Arthothelium subilicinum* (crustose lichen, Arthoniaceae) which is reportedly not been collected since 1881 and is known to occur only in the north-eastern part of India and Sri Lanka so far (Singh & Sinha, 2010).

4. Record of four standing individuals of *Cyathea nilgirensis* (Cyatheaceae, Near-Threatened tree fern) which is a new report of its distribution anywhere from north of 14° latitude in the Western Ghats.

5. The major anthropogenic factors were identified for the different forest habitats of central Western Ghats and its scale of impact based on disturbance scores was calculated.

6. The ecological indicator value of lichens was further fortified and established for the forests of central Western Ghats.

7. Based on the results of the study and field observations, appropriate conservation strategies are suggested for pteridophytes and lichens which would aid the decision makers in formulating the management plan.