

Chapter VI

Conclusion

Orchids being high value crops with fascinating and showy flowers are always sought after by Orchid enthusiasts, researchers and traders. The best way of protecting the remaining Orchid resources of the region is to convince people about the importance of this dwindling wealth. In India, there is a good law for the protection of such valuable plant species. However, law enforcement cannot protect these plants which are available in remote forest areas. Thus, their best route to their protection is by making the local communities aware about the importance of this threatened species in maintaining the balance ecology. The greedy nurserymen of the locality should be banned to enter those areas or forest where Orchid diversity is very high. With the initiation of local self governance in Darjeeling, in recent days concrete step can be taken in order to save whatever Orchid species are left with us after the rampant destruction of the floristic wealth of this region.

Whole Orchidaceae family has been facing high risk of threat in a natural habitat in comparison to other plant species in this present studied region. Therefore, in near future, the Orchidaceae family as a whole may become endangered. An immediate measure has to be taken for conservation of these species before they extinct, especially for those species which are rare and threatened. It is a high time now that conservation measure must be implemented before these species are vanished forever from the nature. Therefore, protection and conservation of natural habitat may only be the prominent way to save our precious natural wealth of Orchid species of the regions.

We are lucky to have these diverse plant species still intact in the nature (although in fragmented habitats) however, many are in the verge of extinction. The ever increasing population needs space coupled with the expansion of cultivable land are normally acquired by clearing forest land. The indiscriminate collection made by the paid agents of floral nurseries and other related businessmen for the purpose of export

and home decoration is one of the serious reason for huge loss on valuable biodiversity of many species like *Cymbidium*, *Coelogyne*, *Dendrobium* species which has to be considered seriously in order to protect them intact in their natural habitat. However, to achieve such goal, effective steps have to be taken immediately in order to safeguard the Orchids germplasm within a targeted time period.

The entire Himalayan regions have been facing the threat of plant species extinction due to population pressure and Darjeeling Himalaya is not an exception. Further, the region being highly prone to landslide, many valuable plants are being lost each year. There is an urgent need to develop strategies on this issue. It is observed that the luxuriant growth and diversity of the Orchid species in the undisturbed sites of the study area and the meager development in distressed sites clearly indicates the change or disturbance in the microclimatic conditions in habitat by multiple anthropogenic activities. At present, number of Orchid enthusiasts, researchers and traders visit the region each year in search of Orchids and they give handsome amount for providing planting materials. Although the trade of Orchid species is banded by law, but the way the species are vanishing from their natural habitats everyday is still a mysterious to law enforcers.

The Orchid habitat is mainly determined and influenced by such factors as temperature, elevation, amount of rainfall, humidity, light and shade, type of soil, soil pH, and vegetation, and micro-climate in a given region. Certain species are also specific in their habitat requirement. The rich diversity and resources of Orchid species of Darjeeling Himalaya has been degrading due to the rampant illegal collections made by local traders and businessmen for earning handsome money. Such collection is an age old practice in Himalayan regions. While collecting luxurious Orchid plants, collectors uproots everything, leaving effectively nothing in the natural habitats. The Orchid species having commercial value in both national and international markets were the first to be exploited. Fortunately, healthy population of Orchid are still found to be grown at different elevations in remote villages and forests, and these can be utilized in breeding purposes for the creation of more species and hybrids. These germplasms are the real natural wealth which is still with us and now there is an urgent need to ensure their protection, retention, and proliferation in their natural habitats.

Darjeeling Himalaya being a part of one of its biological hot spots of the world, it is very rich in flora and fauna. It was first explored by Sir J.D. Hooker during 18th century for the plant wealth and later by many other like Brühl, 1926, Pradhan, 1976 and 1979, Pradhan & Pradhan, 1997. However, considering Orchid alone as the plant wealth of this region was never taken up any researchers and the same has been done in this investigation to find out the availability and present status of Orchids of this region. The Orchid diversity of Darjeeling Himalayan region has never done in the length and scale that has been carried out this time. The entire region is surveyed and detail findings are presented here.

Kalimpong was well-known for floral business for over 60 years back in India which was exploring Orchids to number of countries in the West. This is one of the reasons why the Orchid population of important species gradually vanished from this region. We cannot regain the lost of genetic material ever but whatever is left out can be saved for future generation. The available law can be strictly implemented to retain our genetic materials. The tissue culture technology could be utilized for the mass multiplication of the available Orchid species and such plants could be planted back in the nature.

During investigation, it was realized that there is tremendous scope of breeding of new hybrids with special characters like fragrance, different perianth shades, longevity of flowers, cut flowers, pot plants etc. lots of important and new characters could be added in the available list such as *Paphiopedilum* have showy flowers if we can incorporate fragrance to them, it adds to their value. The most common cut flower Orchids is *Cymbidium* and *Dendrobium* hybrids. Additions of fragrance in this will greatly improve their commercial value. However, this is not an easy task, but with the available technology on genetic manipulation, it is not impossible to achieve.

Uses of Orchids as medicinal plants are reported from various region of the world. Further, studies on this line could be carried out in order to find out the possibilities of the new uses of Orchids other pharmaceuticals. There are forty eight medicinal and 16 ethnobotanically important Orchid species found in this region. Maximum income can be generated, if commercialization of some of these potent medicinal Orchids is done by big pharmaceuticals and/or growers these regions.

The most important of all of these is the initiation of making Orchid a household enterprise.

All people living in this region should adopt Orchid as one of their enterprises for earning their livelihood. It grows naturally in the region as it is a natural home for number of species, the growing of Orchids in the commercial ways: big or small, depending on one's available resources can be made to improve the economic condition of poor rural populations. The newly formed Gorkhaland Territorial Administration (GTA) could come forward to implement this novel idea to make the region an Orchid growing region of the world.

The taxonomic studies of the plants indicated that some minor variation in plant does exist in nature which was not detected by the earlier workers. However, only one new variety was identified and is named as *Geodorum densiflorum* (Lamk.) Schltr. var. *kalimpongense* Rajendra Yonzone *et al.* This new entry is reported in the Journal of McAllen International Orchid Society, U.S.A. considering the way the entire study area was covered during the study period, it may be said that there may not be any more new species available in the region. Present survey reports fourty one new records from the region. This is also an indication of species richness in the region. It was found that some species were introduced in the region from North-Eastern States of India and these were not seen anywhere in the nature except in the gardens of the local nurserymen. But those species were well acclimatized in the climatic condition of the region and blooming nicely as in their natural habitat.

The loss is permanent. This way, we have lost number of Orchid species forever. Some species although are not completely lost, but their number has drastically came down. However, despite of all these, we still have ray of hope and whatever is left could be saved and utilized for creating more new hybrids for future generations.

Some Orchid species like *Cymbidium longifolium*, *C. hookerianum*, *C. erythraeum* and *C. mastersii*, are rarely available in wild but frequently found in the planted condition at home garden of local villagers of nearby forest areas in the region. By means of such domestication, survival and existence of such species are still available in this region.

The amount of effort needed for floristic work is increasing, as is the diversity and importance of ways in which floristic information is being used and the number of people who have a direct interest in floristic data. Therefore, Darjeeling Himalaya is such a region where complex combination of hills and the plains are available. Floristic survey of hilly regions is very tough because of poor transport facilities, unavailability of suitable lodge during survey, carrying bulky amount of food materials, expensive lodging, torrential rain, leaches, snakes, bear and leopards inside the forest, struggle with defraud minded people makes the survey work tedious and cumbersome. Nevertheless, aesthetic beauty, vegetation wealth, pure drinking water and hygienic food welcomed many visitors, trekkers in the region.

Darjeeling Himalaya holds rich Orchid species. Significantly, many forest areas have been recorded as the many rare habitats of numerous threatened species like *Agrostophyllum planicaule*, *Anoectochilus grandiflorus*, *Bulbophyllum apodum*, *Ceratostylis himalaica*, *Cheirostylis griffithii*, *Cryptochilus sanguinea*, *Cymbidium hookerianum*, *C. mastersii*, *D. praecinctum*, *Eria biflora*, *Galeola lindleyana*, *Liparis cordifolia*, *Luisia brachystachys*, *Odontochilus grandiflorus*, *Peristylus fallax*, *Pinalia graminifolia*, *Pleione maculata*, *Pomatocalpa armigerum*, *Rhomboda lanceolata*, *Tainia megalantha*, *Vanda alpina*, *Zeuxine affinis*, *Z. reflexa* etc.

The present study also revealed that there are many species which are in the verge of threatened and gradually becoming rare. Their population has been gradually decreasing in alarming rate. Population pressures from surrounding areas cause greater harm to the natural population of Orchid species. It is a matter of fact that the interference of the region through various undesirable means is identified as a major issue in regards to conservation of biodiversity in the region at present context. These factors were perceived to be the great threats to the existence of the region, its ecology and its floristic resources as a whole.

The Darjeeling part of the Himalayas has its own climatic peculiarities due to its geographical location, relief and wide range of altitudinal variations ranging from ±120 m to 3660 m amsl. The varied climatic, physiographic, altitudinal range and the edaphic factors have enabled the region to evolve the rich diversity of Orchid species. The different conditions of slopes, small terraces, hill ridges, river valleys, and the diversity

of habitat conditions, and the diverse type of vegetation conditions have altogether contributed to its unique and diverse floristic diversity. The major climatic variation in Darjeeling is based mainly upon the elevation. The climatic variation is also responsible for the creation of wide range of vegetation structure including Orchids, and it supports the survival of great biological diversity.

Darjeeling Himalaya is bordered by Sikkim in the North, Terai and Dooars in the South, Bhutan in the East and Nepal in the West. Entire regions being one of the most inaccessible and difficult terrains, its comprehensive survey of Orchid species carried out over the past seven years. The present survey of Orchid flora of the region had some advantage in enumerating the flora of adjoining parts of Sikkim and Bhutan as the areas of Singhalila National Park and Neora Valley National Park are extended sharing their common international boundaries. The present survey has enabled to amass over 940 herbarium specimens, now stored at the Herbarium of Department of Botany, St. Joseph's College, Darjeeling and Taxonomy and Ethnobiology Research Laboratory, Cluny Women's College, Kalimpong.

The present field study of Darjeeling Himalaya recorded a total of 321 species of Orchids belonging to 86 genera which is remarkably a high figure in a small geographical land mass. Of them 52 genera with 219 species are epiphytic, 34 genera with 100 species are terrestrial and 2 genera with 2 species are saprophytic. Darjeeling Himalaya is a small region with very rich gene-pool of Orchid species. The region is rich Sino-Himalayan, Japanese, South-East Asian and Malaysian elements.

The present survey was concentrated only on the Orchid flora. Therefore, it has great scope to study the diversity resources of other flora of the region. Some species in the region are found to be pantropic and cosmopolitan species and some are introduced from North Eastern states. The Orchid flora of Darjeeling Himalaya has very high endemic value as well. Many endemic Orchid species of Eastern Himalayas are well represented in the flora of Darjeeling Himalaya.

The Orchid species richness of Darjeeling Himalaya gives a tremendous scope and avenues for the taxonomic rank delimitation of the species, varieties and also for the determination of *ecotype*, *var. nov.* and *species novo* at micro level. Therefore, it is obvious that more *varieties*, *ecotypes* and the *species novo* are expected to be evolved in

the future through the course of long drawn-out process of mutation and selection in the given physiogeographic conditions.

Above all, Darjeeling Himalaya holds store-house of medicinal Orchid species with tremendous scope for future use. Besides, it also holds ornamental Orchid species and jewels Orchid species. These species have good market potentials especially in abroad. If such species multiply largely and commercialize by growers, it will becomes income generating sources for rural mass.

Most importantly, the region is housing numerous endemic species of Himalayan, particularly of Eastern Himalayan region. Considering all these facts, the Orchid diversity resources of Darjeeling Himalaya need to be conserved with topmost priority. It is the matter of fact, that the region with tremendous diversity in species level is a part of the Himalaya Biodiversity Hotspot. Therefore, the safeguard of the region through effective enforcement of the laws and implementation of advance and cost effective conservation efforts is a need of the hour for effective approach for the conservation and promotion of the rich “Orchid gene-pool”. Therefore, a greater part of responsibility lies with the Department of forest and its personnel needs to play vital role in exercising their duties with utmost sincerity, accountability and the credibility to ensure the forest region safe and secure home for all its biodiversity. The Department of Science and Technology and Department of Horticulture, Food Processing, Government of West Bengal and local Government of Gorkhaland Territorial Administration (GTA) must take up intensive study in regards to the status of useful Orchid species for conserving and improving their population structure as well as developing proper methods of their sustainable utilization through the mass cultivation of some such species involving local people of the region.

The management of biodiversity requires assessments of diversity at community and habitat diversity, the species diversity and the genetic diversity. The strategy of conservation of Orchid species diversity resources of the Darjeeling Himalaya is to be drawn after taking into consideration all the factors and to ensure that the Orchid flora of this region not only continues to survive but maintains and conserve the natural habitat for the evolution of the Orchid flora for origin of new taxa.