Chapter 7

Summary
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The study on the genus *Carex* L. was performed based on 23 species, including 2 varieties, collected from North-eastern India, mostly from the Sikkim Himalaya and Darjeeling Himalaya of Darjeeling district of West Bengal, during 2007 to 2012. In all the cases life-specimens were studied in the field itself for habit and habitat nature and in this regards several populations had been regularly observed. Beside these a few previous collections were taken into consideration from the other states of North-eastern India for the study of floral biology.

Sufficient specimens of each species were collected, preserved as herbarium specimens in the herbarium of the Department of Botany, University of Kalyani, Kalyani, Nadia, West Bengal.

Most of the morphological characters of vegetative organs were studied in the field as *in-situ* condition and the morphological features of reproductive organs were studied in the laboratory. For each species a number of populations and a good number of specimens were examined. Based on the characters studied all these collected specimens were identified properly and the correct nomenclature of each species is provided.

Photographs of habit and habitat characters were taken in the field. The dissected floral plants were kept and the drawings had been made based on observation. The number of module in a plant is the important feature for the study of *Carex* L. The genus *Carex* L. has a complex structural pattern of rhizomes, unground level and ground level stems, aerial part as culm. There are different counts of the presence of module per plant. So also there are different types of culm structures including leaf-sheath base, bracts and bract-sheath bases for inflorescences. All these characters were studied in the field itself. The inflorescence pattern i.e. the synflorescence, pseudoflorescence, spikes, peduncles, distribution of sexes in a spike, ratio of the distribution of sexes were studied for each species of *Carex* L. The analysis of inflorescence nature, from simple to complex synflorescence nature was thoroughly discussed.

The arrangements of different types of floral glumes as male, female and sterile ones were thoroughly studied. The appendages in anthers are also important features of interest as like the stigma and the apices of glumes. So, all these characters are studied. Utricles and nuts are the
important features of interest in *Carex* L. and thus the light microscopic study (LMS) and scanning microscopic study (SEM) are provided. The presence of silica bodies and the different types of silica bodies were observed under scanning electron microscopy.

Anatomical studies were performed for the culms and leaves of 23 species of *Carex* L. Anatomical study of Indian species of *Carex* L. are almost absent and now added. The anatomical features of lamina are providing many characters of identity as also for the anatomy of culm.

Based on the both morphological and anatomical study of 24 taxa of *Carex* L. the important aspects of characters were emphasized. These characters are analyzed to emphasize the phylogeny and evolutionary aspects within *Carex* L.

Each species was described, arranged according to Dai Lunkai *et al.* (2010) followed by the key to the subgenera, key to the sections and key to the species whenever there are more than one species under a section. For each species, the nomenclature, morphological description and then anatomical descriptions of culms and leaves are provided.

Mycorrhizal association of *Carex* L. for Indian species was least known or almost absent. A separate chapter is provided for this study. Many of the important observations are the first report in regards to mycorrhizal association in 12 species of *Carex* L.

As a whole this study is provided with field observations of species and population, study of different morphological macrocharacters, study of light microscopic features of floral biology, scanning electron microscopic study of utricles and nuts including the silica bodies, anatomical features of culms and lamina of 24 taxa. Both the anatomical studies of culm and lamina of Indian species of *Carex* L. are the first time from India. Mycorrhizal association of *Carex* L. is provided for 12 species. This is also the first time report from this region of India. Based on the study of the morphological and anatomical observations artificial keys are provided for the easy identity of species.

In all the cases photographs, drawings and diagrams were provided. Besides the observations a general discussion is provided for the genus *Carex* L., its classification, systematics, phylogeny and evolution. Review of literatures is provided for the study of the genus
Carex L. However, most of this works were done for the species found in other countries as there are least works on Indian Carex L. except the taxonomic account came out in different floristic study.

Discussion and conclusion are provided to emphasize the features of important characters of Carex L., both from morphological and anatomical studies of 23 species of India.

The references of relevant literatures are much more as being number of species of Carex L. is nearly 2000 distributed throughout the world. Under every cases of the earlier study of the literature is cited whenever required.

Thus this study is done based on 23 Indian species of Carex L. found in North-eastern India providing details of morphological characters, anatomical characters, SEM study of utricles and nuts, mycorrhizal association and finally importance of these characters of Carex L. for phylogeny and evolution. Moreover, the anatomical study and the mycorrhizal associations are the first time report from this region of India.