

Chapter-V

CHAPTER V

Materials and Methods

5.1. THE FIELD WORKS

The entire virgin area of Pangolakha ridge was surveyed during the years 2001 to 2007 with the assistance of Forests, Environment & Wildlife Department, Government of Sikkim. Based on the available negligible literature, records, publications on the status of flora and fauna, it has been assumed that the Pangolakha ridge is certainly been not visited by any individual or group for floristic studies point of view, except by a team comprising of forest department, Government of Sikkim and World Wide Fund (WWF) Sikkim circle in 1999 - 2000 (a unpublished report Forest. Dept. Govt of Sikkim.(Anonymous 2000). Prior to the onset of survey, the base map created by forest department in the same year was extensively studied and recorded the altitudes and the distance in kilometers between the places in the first phase. After the drawing and enlargement in the derived scales the trekking routes campsites were fixed in different blocks of the areas from the altitude 1981m to 4724 m. After the thorough consultation with forest department local people and tourist guides (mountain trekkers) and army, personals including police the routes to reach dense ridges in deep forests in all the parts of the sanctuary were identified and chosen at different sub-ridges of Pangolakha.

The Sanctuary being located at the boarder areas to China and Bhutan, the frequent survey over few of far interior of pockets Dokala, Dongchula, and towards Batangla was imposed restricted by the army personnel. However, the sanctuary with the areas of virtually huge and inaccessible, several ideal places were identified as base camps. These are Kupup, Padamchen, Pangolakha, Rachela, Hathi cherey, Phusrey dara, from where many sub-camps were further identified wherever necessary. However, availability of some basic necessities like water, proper shelter, enforced us to shift the campsites other than identified spot.

The field surveys was initiated with the optimum plans and information of the ridge including methods of collecting plant samples in the field and the hiring of survey equipments including tents and trekking equipments from Namgyal's tours and travels, Tibet road, Gangtok . Forest personnel from department of forest were officially deputed in all survey that has been made between 2001 and 2007 for field guide, for every single survey minimum of

three to four porters was employed to carry the luggage including tent and trekking equipments. After the first preliminary studies conducted in year 2002, the entire pockets of Pangolakha ridges were explored simultaneously in every seasonal interval until 2007 and recorded the distributions and habitat status of different taxa. During the survey, the samples of the plant materials were collected initially in the bulk, which contained all types of specimens and are recorded properly in the field notebooks.

The major portion of the Pangolakha Wildlife Sanctuary is occupied by the part of alpine and sub-alpine vegetations; the areas remained under the snow cover for minimum of four to five months in winter and the climatic conditions of the ridges is extremely harsh. Therefore, survey team must acclimatize with the climatic condition of different altitudes of the ridges before undertaking minimum 20 days field trips.

In order to provide security and to maintain back-up support for the needs of other teams for field activities three numbers of control room was temporarily being installed at Padamchen range forest check post and Rongli range forest check post and Kupup range forest out post. The communication between scientific team and the control room was maintained through mobile phones and walky-talky provided by forest department. However, the ridges of Pangolakha sustain extremely reliable network for mobile phone after the year 2003, which enabled the team to communicate with the head quarter, Gangtok, as and when required.

Pangolakha ridges are one of the most difficult terrain and practically inaccessible to its interior without the help of the local guides. Therefore, the progress of every activities of the field is proportional to their numbers. Significantly, the minimum time taken to visit in between two-control rooms was not less than eight to nine hours walking on foot every day. Since, the sanctuary is the repository of many furious wild animals like tigers, leopards, bears, Takins and Wild boars, however the alternative security system was provided by the department of forest, wherever it was practically necessary. Most recently constructed trekker's hut / Barrack at Rachela and Pangolakha by tourism department of Sikkim was used optimally for the studies. However, in several other places the camping was done away at the several natural caves or abandoned wreck cowsheds (*Goth*). The forest check post at Kyongnosla, Kupup and Lingtam are few other places where the staff of both forest and police department had provided a commendable support and extended needful help.

5.2.PROCESSING OF SPECIMENS

The methodology as suggested by Jain & Rao (1977) was followed in general for this work with minor modifications wherever it was essential. Generally, specimens were collected in triplicate preferably in their flowering as well as in fruiting stages, but rarely in vegetative stage. With the complete recording of field-characters in field notebooks, the specimens were temporarily preserved in polythene bags, with the mouth being kept tied perfectly; not letting the access or exit of air. The specimens collected in the field were further processed with trimming of infected parts and selection of better and young parts, cleaned and placed in blotting papers. Drops of formalin were added in different parts of specimens to check the decomposition and fragmentation. Blotters with specimens were then put into a light herbarium press and tied tightly with rope. In order to absorb all the moistures from the specimens, the blotting papers used in the herbarium press were changed regularly along with the repositioned of each specimen continuously for at least three to seven days at the campsite.

However, the specimens after bringing back to the laboratory were transferred to a heavy plant press, kept in a hot-chamber, changed blotters in regular interval until dried properly. All the specimens were then properly poisoned with 6 % solution of $HgCl_2$ in rectified spirit (ethanol).

Further, the specimens were mounted on standard herbarium sheets (41.5×28 cm) using glue and stitched with threads. There after the herbarium labels (15.5×10 cm) with important information recorded in the field were fixed on the right hand bottom side of each individual sheet.

These labels contained the following important information (a) Area under exploration, (b) Family of the plant, (c) Name of the plant, (d) Field number, (e) Date of collection, (f) Vernacular names, (e) Habit and habitat, (f) Place of Collection or distributions, (g) Altitudes (h) Flower color, (j) Use, (k) Name of collector and determinator; etc.

The specimens were then stored temporarily in steel cabinets in the laboratory for further study.

To record the exact period of flowering and fruiting different areas were visited frequently in different seasons. Since majority of alpine plants are annual and short living, they deserved to visit between the month of April to July for flowering and August to November to study the fruiting stage.

5.3.IDENTIFICATION, AMASSMENT AND DEPOSITION OF SPECIMENS

The specimens were identified in the Taxonomy & Environmental Biology Laboratory of the Department of Botany, North Bengal University and in the herbarium section of the Sikkim

Hill Circle of the Botanical Survey of India, at Gangtok. For this wide range of literature (floras, monographs, revisions, etc) were consulted including Hooker (1849 – 1851, 1872 – 1897), Hara (1966, 1971), Hara *et al* (1978, 1979, 1982), Ohashi (1975), Grierson & Long (1983, 1984, 1987, 1991, 1999, 2001), Karthikeyan *et al* (1989), Hajra & Verma (1996), Noltie (1994, 2000) and Pearce & Cribb (2002). After identification in the laboratory the specimens were then matched at different herbaria including that of Sikkim Forest Department, Deorali, Gangtok, BSHC, NBU and CAL.

After completion of the work, three sets of the specimens will be deposited in (i) NBU-Herbarium; (ii) Sikkim Forest Department Herbarium and (iii) BSHC.

The detail morphological studies of each specimen were undertaken at both the Environmental Biology laboratory of department of Botany, university of North Bengal and at herbarium section of the Sikkim Hill Circle of the Botanical Survey of India. Specimens were described mostly using common technical terminology. The description of the specimens was supported with the proper measurements and with the recognition of some special characters; those differentiate between the specimens studied.

5.4 METHODS OF ENUMERATION

The basis of framing up of present flora of Pangolakha Wildlife Sanctuary is the classification presented by Arthur Cronquist (1988). However, with the availability of recent literature including *Flora of Bhutan* (Long & Grierson 1983, 1984, 1987, 1991, 1999, 2001) and *Flora of Sikkim* (Hajra & Verma 1996) facilitated the work. Dahlgren *et al* (1985) Cronquist (1981), Dahlgren (1980) and Hutchinson (1973) has been chiefly followed for the delimitation of families of the flowering plants of the PWS flora. As far as possible up-to-date nomenclature of plants has been used in terms of the provisions of ICBN. However, genera within a family and the species (and infraspecific categories) within a genus were arranged alphabetically. Proper artificial dichotomous Keys were provided for the identification of genera, species and infraspecific categories. The legitimate correct name of the species is printed in italic-bold and that is followed by basionym and selected synonym(s), if any, in italics only. The local and vernacular names recorded for different species of plant from the field through interaction with the people of local community residing in periphery of sanctuary have been clearly mentioned in the profile of each species. The local names of the species are in the Lepcha and Nepali languages.

The present status of the species in its natural habitat, data of collection and the local and general distribution for each taxa have also been clearly indicated.