

MATERIALS AND METHODS – 3

3.1. INTRODUCTION

As an approach to the present study, a well-planned exhaustive field works covering almost all the pre-dominant seasons throughout the year from various habitats were conducted since last five years. Detail information on each palms and rattans species of various habitats of West Bengal has been recorded carefully. The present dissertation is covering a number of aspects by using wide array of conventional methodologies that were adopted and has been discussed below:

3.2. Floristics

Extensive field surveys in different agro-climatic zone of the West Bengal in various pre-dominant seasons were executed during last five year (2013–2018). All the species of palms and canes and their population were recorded in details. To understand the actual and proper palm and canes diversity of indigenous species in wild habitat and exotic species in various parks and roadsides in this part of the country, following methodologies were applied using techniques basically devised by various authors (Jain and Rao 1977; Chowdhury 2009; Basu and Mondal 2013; Chowdhury *et al.* 2016; Mondal and Chowdhury 2018; Paul Chowdhury 2019) with some modifications wherever it was essential.

3.2.1: *Sampling Specimens*

Leaves, cirrus, inflorescence, infrutiscence parts of palms and canes were collected in bulk at random from different habitats round the year, covering all the three predominant seasons during 2013 to 2018. During specimens collection mostly flowering and fruiting stages were targeted for easy identification and good voucher specimens. For this purpose in many cases repeated visit to the same spot were made sometimes even within a week.

3.2.2: *Record of Field Data*

During collection, palm and cane specimens were tagged properly and necessary field data like colour on different plant parts including flowers, absence or presence of exudates, scent / aroma, habitat structure, association, population structure, etc. were recorded in the *Field Note-Book*. The ethno botanical uses of palms materials

were investigated through direct interview using some standard questionnaires to the local ethnic communities and village peoples and also observation on direct uses were recorded in the *Field Note-Book*.

3.2.3: Processing and Drying of Specimens

At the field camp or at the laboratory, the collected specimens are cleaned and trimmed suitably, displayed properly on blotters (blotting papers and old news-prints) and then dried in wooden Plant Press. Before pressing, most of the specimens were treated with 6 % formaldehyde (HCHO) solution to avoid fragmentation of specimens and to eliminate chances of decomposition through fungal infestation. Soft plants parts are kept in a separate light-weight Plant Press, where the pressure was increased very slowly and much frequent change of blotters during the first few days of the drying operation. For other plants blotters were changed with regular frequency in a heavy wooden Plant-Press until drying. During moist season for proper drying a Hot Air Oven was used with temperature adjusted at 40–45° C. Generally specimens were completely dried out within one or two week time.

3.2.4: Poisoning of Specimens

After drying all the palm and cane specimens were poisoned with 6% ethanolic solution of Mercuric Chloride (HgCl₂) and dried again in blotting papers for a day.

3.2.5: Mounting and Labeling

After poisoning, specimens were mounted on standard Herbarium Sheets. Later on a label was attached, in most cases, near the right hand bottom corner of the sheet, which bears the Field No, date and place of collection, scientific name, family, local name, field-characters and the name of the collector. Mounted and labeled specimens were stored temporarily in a steel cabinet for further use during the present dissertation.

3.2.6: Identification

After the mounting, specimens were taken under critical study and identified initially matched with the pre-identified specimens in NBU-Herbarium and also with character matching with the different Taxonomic literature by various authors (Prain 1903; Basu 1992; Noltie 1994; Basu and Chakraverty 1994; Renuka 2011; Peters and Handerson 2014). Further confirmation of identification the specimen, several

virtual herbarium (K, TAI) and online floras were also consulted time to time. Some unidentified specimens were taken to CAL for matching with herbarium and consult with experts in palms and canes before finalization.

3.2.7: Storing the Herbarium Sheets

Among the entire prepared specimens, one set of voucher specimens were be deposited in the NBU-Herbarium against specific Accession numbers and the duplicates will be deposited at CAL Herbarium for future reference for global access and as the evidence of the present work.

3.3. Growth Forms

The secondary meristem activity that causes thickening of the stem in dicot plants is absent in palms. In palms, all tissues are formed by the activity of the terminal bud (meristem) and this is the reason why a palm does not grow in length until it attains its maximum girth. In spite of the absence of secondary growth activity in the stem, a number of palm species increase their girth by the expansion of the ground tissue together with the expansion of fibrous tissues which constitute the sheath of the conducting tissues. As these expansions of tissues are not restricted to any particular zone of the stem it is therefore termed as diffused secondary growth (Tomlinson 1961). Growth forms of different palms and canes were determined by observing how a palm species overcome the adverse environmental conditions. Growth forms were recorded as suggested by (Raunkiaer 1934; Basu 1994; Chowdhury 2009; Chowdhury and Das 2013).

3.4. Phenology and Mode of Pollination

On account of the multifarious flowering behavior in palms it is difficult to study the phenology of the major groups in their natural habitat, which is required to a great extent in propagation, hybridization and *ex-situ* conservation of rare and endangered palms (Basu 1994). Studies of phenology and pollination technique of various palms were recorded through repeated observation on the different stages of the growth and development in their *in-situ* condition during the period of August 2013 to June 2018. During this study different phenophases of naturally growing palms have been recorded, which includes germination / sprouting, leaf development, tiller formation, stem elongation, inflorescence emergence, flowering, fruit development, ripening of fruits and seeds and senescence have been noted for all palms species following the

conventional methods as suggested by different authors (Caprio 1966; Wang 1967; Leith 1970; Croat 1975; Basu 1991, 1992 and 1994; Sivaraj and Krishnamurthy 1989; Chowdhury 2009). Pollination types and agents were also observed and recorded on *in-situ* condition. For the observation of phenology and pollination, *Mahananda wild life sanctuary, Bangdubi Forests, Sundarbans (Jharkhali), Dalgawn forests*, and other areas located within the campus of North Bengal University (*Padmaja Park*) were mainly visited and taken under study.

3.5. Economic uses of Palm and Canes

3.5.1. Traditional economic uses

The indigenous people of the tropical world from the preindustrial period have an intimate relationship with the natural resources of their environment. Wild and cultivated plants and wild and domesticated animals both provided all the food and others they needed for living. For the world's food source three most important plant families are grass family (Poaceae), the legume family (Fabaceae) and the palm family (Palmae/Arecaceae). The utility of these three plant families were known to human kind since the ancient time.

Palms occupy a very important position among all economic plants, as they are one of the major sources of man's food. One of the twelve plants basic to human nutrition is coconut, a palm. Tender leaves, young inflorescence, pith of the stem, fruits and seeds, endosperm of many palms are edible and provide all the nutritive materials for healthy living. Species of wild palms and canes have also local and commercial uses as source of food, sugar, wine, oil, fibers and various other items of uses such as building material, furniture in the form of wood, cane, and leaves. Soft young leaves are also useful for making various household items. Due to high nutritive and medicinal values of the edible portion of coconut palm, Date palm and Areca palm, they are commercially cultivated. Local, medicinal, commercial and ethnic uses of indigenous palms however are more to be known through extensive survey, wide interaction and document research. Various authors (Basu 1991, 2012; Basu and Chakraverty 1994; Mondal and Chowdhury 2016, 2018) have been recorded food and medicinal uses of some indigenous palms and canes from this part of India. Now efforts were made to record some more information on different uses of indigenous palms, some are of great interest not earlier known.

Common uses of various semi wild, cultivated and domesticated palms and canes along with their economic values were collected from the existing published works of various authors (Basu 1991, 2012; Basu and Chakraverty 1994; Chowdhury 2009; Basu and Mondal 2013, 2015; Mondal and Chowdhury 2016, 2017, 2018) or by direct observation on uses of palms and cane based products.

3.6. Ethno botanical Investigation

The complete methodology for the ethnic uses of palms were primarily based on the interaction with the various ethnic communities of Darjeeling-Kalimpong Himalaya, Sub-himalayan terai-duars, plains of Bengal and western plateau. Peoples of various ethnic groups were directly using different parts of palms and canes in their livelihood. During study entire data regarding traditional uses of palms, canes and their mode of utilization were documented scientifically and properly photographed following the conventional methods as suggested by Jain 1981, 1987, 1991; Rai 2002; Sarkar 2011; Chowdhury 2015; Basu and Mondal 2015; Mondal *et al.* 2017). A set of questionnaire prepared based on the model (Jain 1991; Chowdhury 2009 and Sarkar 2011) for the present study. The extensive fieldwork were carried out in different villages of terai and duars, (Nishi Gunj), villages of Darjeeling and Kalimpong hills, South 24 Parganas, Bankura, North 24 Parganas in West Bengal. Enquiries were made on their daily life, food habit, fodder collection, occupation, health practices, medicines, trade, beliefs, rituals, ceremonies, traditions and customs using a pre-designed questionnaire.

3.6.1. Observing the Daily Life

Direct observation on the daily life in ethnic society including food and traditional liquor preparations, process of making of instruments for different activities etc. helped to record the related plants and to understand their uses much easily. The daily or weekly markets (*haats*) were also frequently visited to study the market ability of wild and cultivated palms as vegetables and other purposes to collected and/or produced in this area. During daily life observation several palms were recorded as edible plants, food plants, medicinal plants, fodder plants, and highly economic palms etc.

3.6.2. Plants and their Economics

The village dwellers are directly depending on many wildly grown economically important palm species. Such economically imperative palm species of the study areas were also recorded during survey. To execute this part of the work several literature on

various uses of different palms by various ethnic groups, as well as by local poor/village people were followed and discussed. Apart from that, data procured from literature were matched and authenticated with the same species from the present investigation through door to door interactions with local poor and ethnic people and tried to understand the commercial values of those palms materials especially in the local markets. This part of the work was designed and executed by following workers like Kirtikar and Basu 1935; Chopra *et al.* 1956, 1969; Jain 1991; Basu 1992; Basu and Chakraverty 1994; Shah and Das 2002; Chowdhury 2009; Sarkar 2011.

3.7. Palm Destruction

Being civilized we are very rapidly destroying our life land *i.e.* palm throughout the world due to several reasons. The visible physical threats were observed and documented from different forests of study areas. The reasons of palm degradation are categorized into two broad segments:

3.7.1. Anthropogenic threats: The excessive human activities have led to the loss of palms were recorded and photographed. The palms were exploited in order to meet demands of humans. Duration of such activities was tried to measure through direct interaction with field workers during survey.

3.7.2. Natural threats: Most of the palms are solitary or cluster forming due to which cloud fixation occurs at its uppermost portion and consequently leads to the death of the palm. In hilly slopes several palm and cane population were destructed due to huge landslides.

3.8. Conservation

Palms conservation does not advocate a total stoppage of palm collection and utilization because this will deprive rural artisans and craftsmen from earning their live hood and the furniture industries will suffer causing unemployment and resentment. But to save the wild palms and canes species from their rapid extinction visible *ex situ* and *in situ* conservation measure taken by various authorities were observed and noted following methods adopted by some workers like Basu 1992; Basu and Chakraverty 1994; Chowdhury 2009; Renuka 2011; Mondal and Chowdhury 2019.