ABSTRACT

The family Lauraceae comprises a group of flowering plants included in the order Laurales in the Magnoliophyta of the kingdom *Plantae*. The Angiosperm Phylogeny Group classification puts Lauraceae in Laurales under the clade Magnoliids, one of the major clades of angiosperms.

The family Lauraceae is widespread in tropical and subtropical regions throughout the world. The Laurels has a wide range of distribution in India stretching from the coastal plains to the subtropical and temperate regions. Unfortunately, few works were performed on these members particularly, in Terai-Duars belt of West Bengal which is falling under biodiversity hotspot 'Himalaya'. Even complete floristic database of Lauraceae of this region was not obtained through literature survey. As the study on Laurels has not yet completed in Terai-Duars, so there are still some confusions of taxonomic revision of this family, thus, this study will support the taxonomic clarification of these family.

Terai is located between 25° 57" to 26° 36" N, latitude and 89° 54" to 88° 47" E longitude; whereas Duars is situated between 26° 16" to 27° 0" N latitude and 88° 4" to 89° 53" E longitude. The Terai and Duars region politically constitute the plains of Darjeeling, whole of Jalpaiguri and Alipurduar District in West Bengal. The Laurel flora of Terai-Duars region has been prepared through random sampling in three different seasons for five consecutive years, 2008 to 2012. From the present survey the occurrence of 26 species covering 9 genera of Laurels were reported growing in Terai-Duars region. Artificial Dichotomous Keys for the recorded genera and species ware constructed based on significant reliable and easily observable vegetative, flower and fruit characters. All these species were enumerated alphabetically accompanied by local names, salient features, exsiccatus, availability status, flowering and fruiting periods, occurrence in Terai & Duars region and world distribution.

The species of Laurels are economically very important mainly these are used as medicinal resources. Along with these species are utilised in various function like aromatic, edible, spice, timber and many being used in various domestic purposes as well as industrial uses. Although these are economically very important, where as the species of Lauraceae remains poorly recognized and are difficult to identify. In Terai-Duars region eight economically important plants are abundant. Morphologically these eight species are more or less similar. But in every time it is not possible to dependent on morphological characteristics due to both flowers and fruits are used in most generic keys and since specimens almost never bear flowers and fruits, identification is often almost impossible. A drastic remedy for this problem would be to use the different parameters like anatomy, leaf architecture and chemotaxonomy.

After collection and identification of the plant, an attempt was made for study the anatomical characteristics of eight Laurels (*Viz. Cinnamomum bejolghota, C. camphora, C. tamala, C. verum, Litsea assamica, L. glutinosa, L. laeta, L. monopetala*) which are available in Terai and Duars region. All observations were performed on hand-made transverse sections of well-developed stem, petiole and lamina with mid-vain. Double staining method was used for this study. This is the first anatomical

report on the members of Lauraceae from this part of the country. The structural differences are found in several parts like stem, leaf and petiole. In the present study most of the characters are similar in both the genera but distributions of stone cells, air cavities, distribution of sclerenchyma are dissimilar. On the basis the differentiations and similar anatomical characters Higher Archival clustering were drawn. This study concluded that there are two constant clustered groups in these two genera based on similarity in anatomical characters. These groups are: (1) *Litsea monopetala, L. glutinosa, L. leata* and *L. assamica* and (2) *C. bejolghota, C. tamala, C. verum* and *C. camphora*, share a wealth of anatomical characters.

It is well known that leaf architecture is another technique for plant identification. A number of works have been performed on leaf architecture to identify the species successfully and established the relationship between plant species. In the present study, minor venation pattern are distinctly different in *Litsea* and *Cinnamomum,* notable differences in the size and number of areoles were observed. Similarly, the observation of F.E.Vs is also parallel to above results. Various types of stomata were observed in these two genera like anisocytic, diacytic, cyclocytic, anomocytic and anomotetracytic. A dendrogram was produced with the use of such characters showed that *Litsea* can be easily distinguished from *Cinnamomum*.

Chemical constitutions of the plants are stable like structural (morphological and anatomical) features of plant parts. Therefore, for better outcome of identification and relationship of eight species, antioxidant activity, polyphenol content as well as thin layer chromatography were performed.

In this study the antioxidant activity of the different parts (leaf and bark) of eight Laurels were investigated by using DPPH scavenging, reducing power, metal chelating, superoxide scavenging and nitric oxide scavenging assay of the extracts. It is well known that phytochemicals were responsible for antioxidant capacity, therefore quantitative estimation of phytochemicals like total phenol and total flavonoid content as well as qualitative estimation like glycosides, cardiac glycosides, phytosterol, triterpenoids, tannins, alkaloids and amino acids were carried out. In this study, eight different Laurels showed the capacity to reduce oxidation due to presence of high amount of antioxidants. With the help of antioxidant activity (of leaf and bark), two different dendrograms were prepared. However the leaf and bark of eight plants were collected from same plants but the dendrogram was slight dissimilar, because the deposition pattern of the secondary metabolites in bark are stable than leaf. Therefore, in further study we have selected bark of these plants.

The essential oils of Laurels are directly related with the cosmetics and food additives industries. Therefore, the antioxidant activities of the essential oil of eight Laurels were determinate and established relationship within these species. When comparing these species with the cladogram based on the antioxidant profile of essential oil, it was found that *Litsea* genus is separated from the genus of *Cinnamomum*, which is parallel to the grouping developed by the morphological characteristics.

As we have already known that thin layer chromatography is another chemotaxonomic study constitute one of the most important methods of determining the taxonomic positions of taxa. Therefore, with different secondary metabolites like flavonoids, antraquinones, bitter principles, phenolics, essential oils and free radical scavenging screening with TLC figure printing of eight Laurels were performed. By calculating the hR*f* values with different coloured band, a dendrogram was constructed through Agglomerative Hierarchical Clustering (AHC) method.

In all represented phylogeny of the eight species of Lauraceae were different from each other. So, for obtaining more reliable results all data like morphological, anatomical and chemical numerical data

were applied. After the application of these data, an ultimate dendrogram was found where two genera i.e. *Litsea* and *Cinnamomum* were separated.

In conclusion it can be seid that, the methods which were used in present study can help in clustering for solving phylogenic problems. Any family or any kind of plant group like Lauraceae can be easily identify and classify by the above methods. Chemotaxonomy is the process where only needs any kind of plant part for this experiment. So, it is much easier than morphology because of unavailability of flowers and fruits, which are basic requirements for morphological studies. So, chemotaxonomy can be a reliable method for identification of plants.