1.1 INTRODUCTION

Biological diversity forms the basis of life on earth. Plants form one of the dominant group with about 2,50,000 species, 70,000 genera and about 400 families (Groombridge, 1992; Primack, 2006). A major portion of this plant diversity is mainly concentrated in the tropics and India has a significant role in maintaining this diversity. India is estimated to have 17,527 species of flowering plants under 251 families (Karthikeyan, 2009). A major portion of the angiosperm diversity of Peninsular India is concentrated in Western Ghats (Ramesh, 2001; Nair & Daniel, 1986). Kerala, the southern tip of Peninsular India, is a part of the southern Western Ghats.

Kerala is rich in plant diversity with 4681 species of flowering plants under 1415 genera and 188 families (Nayar et al., 2006). Geographical positioning and peculiar climatic conditions are reasons for this exceptional diversity. At present, the biodiversity of the state is under severe threat due to rapid urbanisation, natural calamities, mining and conversion of forest land for agricultural, tourism and religious purposes. A thorough investigation based on bioprospecting is necessary to assess the real plant wealth with particular reference to genera that deserves conservation priorities. In addition, as mentioned by Shenoy (2013), the state is a treasure house of Traditional Botanical Knowledge and no systems exist to assess the threat to the Traditional Botanical Knowledge. The Traditional Knowledge of the state is vulnerable to extinction unless the state comes out with an immediate policy to take care of the Traditional Knowledge and its scientific validation. However, least attempts are made to give value addition to endemic and threatened species by subjecting them for detailed ethnomedical, phytochemical, pharmacognostic and other biological evaluation studies. The present research aims to study the Ethnomedical, Phytochemical and Pharmacognostic characteristics of the Genus *Hydnocarpus* under the family Flacourtiaceae in Kerala, which includes underexploited, endemic and endangered species.

*Hydnocarpus* is an Indo-Malesian genus with 40 species. (van Steenis, 1958; Mabberley, 1997). It mostly occurs in deciduous to evergreen forests and is distributed from sea level to high altitudes up to 2000m. There are five species of *Hydnocarpus* in India viz., *H. alpina*, *H. kurzii*, *H. macrocarpa*, *H. pendulus* and *H. pentandra*. Out of the five species, the four species reported from Kerala are: *H. alpina*, *H. macrocarpa*, *H. pendulus* and *H. pentandra*. This genus is commonly known as *Marotti* in Malayalam, *Tuvaraka* in Sanskrit and *Chaulmoogra* in Hindi. The genus is well known for its use in medicines, especially for...
leprosy and skin diseases. The source of *chaulmoogra* oil, which is traditionally used for the treatment of leprosy, is the seeds of *H. kurzii* (Kanjilal and Das, 1982; Nayar and Nayyar, 1985). The seeds of *H. alpina* and *H. pentandra* are used as a substitute source for *chaulmoogra* oil.

Only few studies are reported on ethnobotany, phytochemistry and pharmacognosy of the genus *Hydnocarpus* in Kerala. Most of the studies reported were based on the medicinal value of the oil extracted from the fruits and seeds of *H. kurzii* and *H. pentandra*. In this context the present research, entitled: “Ethnobotanical, Phytochemical and Pharmacognostic Studies on Genus *Hydnocarpus* Gaertn. in Kerala,” attempts to study in detail the ethnobotanical significance, and the phytochemical and pharmacognostic characteristics of the genus *Hydnocarpus* in Kerala.

1.2 NEED AND SIGNIFICANCE OF THE STUDY

Considerable ambiguity exists regarding the identity of certain species of *Hydnocarpus*. *H. pendulus* Manilal, Sabu & Sivarajan is a new species from Silent Valley reported by Manilal *et al.* (1983). *H. pendulus* is morphologically similar to *H. alpina* and hence Sasidharan (2004) considered the former as con-specific with *H. alpina*. However, the studies carried out on the above aspects are insufficient to resolve the ambiguity between the two species. *Hydnocarpus macrocarpa* (Beddome) Warb. is treated under different genera in different flora because it shows many unique morphological characters. Gamble (1915) treated it under *Asteriastigma* Beddome, Balakrishnan (2005) under *Taraktogenos* (Beddome) Balakr. and Sasidharan (2004), Mohanan (1994) & Nayar *et al.* (2006) under *Hydnocarpus* (Beddome) Warb. Hence, it is expected that detailed investigation based on new tools and techniques in phytochemistry and pharmacognosy will resolve the ambiguity regarding the identity of these species. Further, no detailed investigations were so far reported on the Traditional Botanical Knowledge (TBK) of the genus *Hydnocarpus* in Kerala. A perusal of literature revealed that no detailed studies were done on phytochemistry and pharmacognosy of this genus in Kerala. Hence the present research gains significance in the light of the above mentioned aspects. It is expected that, in addition to understanding the ethnobotanical and ecological significance of the genus, the study will also reveal the evolutionary relationship between the different species of the genus. Further, the study will also provide a means to identify the useful chemical components which in turn helps to give value addition, based on further studies on
bioprospecting of genus *Hydnocarpus* in Kerala. The study highlights the importance of stringent measures to conserve the genus *Hydnocarpus* in Kerala.

### 1.3 OBJECTIVES OF THE STUDY

The major objectives of the study are:

- To study the ethnobotanical significance of the genus *Hydnocarpus* Gaertn. in Kerala.
- To provide a means of solving the ambiguity regarding the status of different species of genus *Hydnocarpus* Gaertn. in Kerala based on phytochemical and pharmacognostic evaluation.
- To develop HPTLC profiles and standards with reference to major classes of secondary metabolites in the genus *Hydnocarpus* Gaertn. in Kerala.
- To provide a pharmacognostic evaluation of the genus *Hydnocarpus* in Kerala based on leaf and petiole anatomy.

### 1.4 MATERIALS AND METHODS IN BRIEF

The ethnobotanical studies were carried out through field survey, interviews, data collection and analysis of relevant literature. Methodology suggested by Cotton (1996) and Jain (2001) were used for this study.

Phytochemical studies were carried by extraction, preliminary phytochemical screening, HPTLC profiling and construction of dendrogram using SPSS software. Standard procedures suggested by Harborne (1973), Kokate (1999), Evans (1996), Sadasivam & Manickam (2005), Reich (2007), Wagner & Bladt (1996) and Shah & Seth (2010) were used for this study.

The methodology adopted for pharmacognostic studies included hand and microtome sectioning, maceration, vein clearing, microscopic observation and tabulation.

### 1.5 SCOPE OF THE STUDY

- Documented ethnobotanical data will provide a baseline data for future bioactivity-based research.
- The study provides a means to establish the phytochemical affinity among different species of genus *Hydnocarpus* in Kerala. It also provides a means for bioprospecting
of this genus with special reference to hypercholesterolemia, psoriasis, cancer and hypoglycaemia.

• The study highlights the importance of conservation priority for the genus *Hydnocarpus* in Kerala.

1.6 MAJOR FINDINGS

1. The present study has brought to light the ethnobotanical values of the genus *Hydnocarpus* in terms of medicinal, agricultural, ecological, religious and economic aspects. The study also revealed the importance of conservation priorities to be given to this genus. The basic ethnobotanical data generated from this study can be used for further validation based on phytochemical, toxicological and pharmacological studies.

2. The present study revealed that all the four species of *Hydnocarpus* are rich in phytochemicals. The major groups of phytochemicals identified from the leaves and bark of these species are: alkaloids, essential oils, steroids, triterpenes, flavonoids, flavonoid glycosides, flavonolignans, phenolics, tannins and saponins. The study provides chemotaxonomic evidence for the identification of the genus and species by providing generic and specific R<sub>f</sub> values. Baseline data for the biological evaluation studies based on genus *Hydnocarpus* in Kerala were also generated in the study. The study has brought to light the evolutionary relationship that exists among different species of genus *Hydnocarpus* in Kerala.

3. The anatomical characterisation of the species viz., *H. macrocarpa, H. pentandra, H. alpina* and *H. pendulus* were done by leaf and petiole anatomy. The anatomical diagnostic characters for all the four species of genus *Hydnocarpus* in Kerala were identified for pharmacognostic evaluation. An anatomical key was also prepared to identify the different species of *Hydnocarpus* in Kerala.

4. As revealed in the present investigation, the data generated by phytochemical and pharmacognostic studies were sufficient enough to resolve the taxonomic ambiguity with respect to *H. macrocarpa* and *H. pendulus*. On the basis of the above evidences, the inclusion of *H. macrocarpa* in the genus *Hydnocarpus* and the status of *H. pendulus* as a distinct species were clarified and confirmed.

5. The study highlights the importance of conservation measures for the genus *Hydnocarpus* in Kerala.