1. GENERAL INTRODUCTION

Medicinal plants offer alternative remedies with tremendous opportunities. They not only provide access and affordable medicine to poor people; they can also generate income, employment and foreign exchange for developing countries (Farnsworth et al., 1985; World Health Organization, 2002; Zhang, 2004). Many traditional healing herbs and plant parts have been shown to have medicinal value, especially in the rural areas and that these can be used to prevent, alleviate or cure several human diseases.

The World Health Organization (WHO) estimates that a minimum of 20,000 plant taxa has recorded medicinal uses. It is estimated that up to 70,000 plant species are used in folk medicine (Farnsworth and Soejarto, 1991) and a majority of these species are found in the Asia-Pacific region. However, the uses of medicinal plants are faced with many constraints. Some of these constraints include: plants with medicinal values not fully identified, invented and characterized, information and knowledge not being adequately documented and disseminated, many issues are not addressed and resolved (i.e. equity and sustainability), and the alarming commercial over-exploitation and consequent genetic erosion of medicinal plants. As an initial step towards resolving this constraint there is a need to develop a sound research strategy and utilization.

Interest in the exploitation of medicinal and aromatic plants as pharmaceuticals, herbal remedies, flavourings, perfumes and cosmetics, and
other natural products has greatly increased in the recent years (Anon, 1994; Ayensu, 1996; Salleh et al., 1997; Kumar et al., 2000). The medicinal plants have been used by humans from the pre-historical times. Studies have pointed out that many drugs that are used in commerce have come from folk-use and use of plants by indigenous cultures (Anon 1994). About 50 drugs have been discovered from ethanobotanical leads by translating folk knowledge into new pharmaceuticals (Cox, 1994). Some examples of medicinal plants from the Asia pacific region are of species such as Rauwolfia, Hyoscyamus, Cassia, Atropa, Podophyllum, Psoralea, Catharanthus, and Papaver.

Medicinal plants contribute substantially to health, cultural integrity and local economics, particularly among the poor, and particularly for women, children and elderly (Rao and Ramanatha Rao 1998; Leaman et al., 1999). For the Indian Himalayan region, a total of 1748 species of medicinal plants-1020 herbs, 338 shrubs, 339 trees, apart from 51 pteridophytes -have been listed (Samant et al., 1998). Some examples of the endangered Himalayan medicinal plants species include: Aconitum balfouri, A. deinorrhizum, Acorus calamus, Angelica glauca, Atropa belladonna, Berberis kasmiriana, Coptis teeta Dioscorea deltoidea, Gentiana kurrooa, Nardostachys grandiflora, Picrorhiza kurrooa, Podophyllum hexandrum, Saussurea costus, Swertia chirata and Taxus baccata subsp.wallichiana; and the sub-tropical/sub-temperate species Aquilaria malaccensis.

Medicinal plants (MPs) played a significant role in various ancient traditional systems of medication such as Ayurvedic and Unanic India,
Chinese traditional medicine and their derivatives. Today, MPs still play an important role in developing countries in Asia, both in preventive and curative treatments, despite advances in modern western medicine. People of many Asian countries earn a living from selling collected material from the forest, or from cultivation of their lands. The development of modern medicine with the introduction of modern drugs produced by pharmaceutical companies, has dealt harshly with traditional medicine which has been accused of being inefficient, laborious in preparation and unavailable due to scarcity of raw material. This is exacerbated by the lack of traditional doctor who cannot earn a living without basic material (MPs) and demand (customers).

The high cost of modern medicines (mostly imported), their unavailability in remote areas and, most importantly, the serious side effects of certain drugs, have resulted in a significant return to traditional medicine. The importance and value of traditional and indigenous herbal medicine was the subject of WHO campaign in the 70’s for all its member countries to preserve their national heritage of ethno-medicine and ethno-pharmacology and to re-include the use of unknown and tested MPs and derivatives into their primary health care system in rural areas and as an alternative when modern medicine is not readily available. Since large portions of pharmaceutical drugs are derived from MPs, the demand for these raw materials is steadily rising. Such demand is met by either obtaining MPs from their natural habitats, albeit indiscriminately, or by cultivating them (Sasson 1996; Natesh 2000).
Asian countries generate incomes via sale of collected, wild products or cultivated products. Collection of naturally occurring MPs has been practiced in Asia since prehistoric time for use in traditional medicine or for processing into pharmaceutical products. MPs continue to play a significant role in the peoples’ welfare as they have been for several millennia. When a plant is designated as ‘medicinal’ it is implied that it is useful as a therapeutic agent or an active ingredient for a medicinal preparation. Medicinal plants are rich sources of bioactive compounds and thus serve as important raw materials for drug production. They constitute a precious natural wealth of a country. Judicious and scientific exploitation of this wealth can significantly improve the general health of the people. And being a valuable commercial item, a country can also earn a good amount of foreign exchange by exporting this natural wealth to other countries. Medicinal plants play a critical role within the framework of a formal health service. Medicinal plants, as a group, comprise approximately 8,000 species and account for about 50% of all the higher flowering plant species in India.

A large number of the country’s rural populations depend on medicinal plants for treating various illnesses. About 1.5 million practitioners of the Indian Systems of Medicine and Homeopathy (ISM and H) use medicinal plants for preventive, promotive and curative applications. Furthermore, there are 7,843 registered ISM pharmacies and 851 of homeopathy as well as a number of unlicensed small-scale units. Besides meeting national demands, India caters to 12% of the global herbal trade. In recent years, trade in herbal-based products has quantum leaped, particularly in the volume of plant
material traded with in and outside the country. The global market of trade related to medicinal plants is estimated around US$ 60 billion per year and is growing at the rate of 7 % annually with varying shares (Fig.1) of developed and developing countries (Dev, 1999; Laird and Pierce, 2002; Raskin et al., 2002).

The global trend towards the use of herbal and natural medicines has been increasing in recent years. More attention from the world community has been given to the tropical rainforest, which is believed to contain 50 % of the world’s biodiversity. Farnsworth et al., (1985) indicated that 74 % of the 121 active compounds used for the development of important modern medicines in the United States, such as digitoxin, reserpine, tubocurarine and ephedrine, are derived from medicinal plants growing in and gathered from tropical forests. In USA, about 25 % of prescriptions dispensed by pharmacies contain a drug that is derived mainly from plants, or with at least one or two main ingredients derived from plants (Fernando 2001; Laird and Kate 2002).

India is blessed with two mega centers of biodiversity: the Hindustan Centre of Origin and the Central Asia Centre of Origin. This biodiversity is mainly distributed in Western Ghats, North - eastern India and the Himalayan region. Floristically rich, India has about 141 endemic genera of 5,150 species belonging to 47 families of higher plants. Among the different endemic species, 2,532 species are distributed in Himalayas, 1,788 species in the peninsular region and 185 species in the Andaman and Nicobar islands. About 43,000 plant species are said to exist in India, of which 7,500 plant species are
referred to in Indian folklore but only about 1,700 plant species have actually been documented in old literature. The proportion of use of plants in various systems of medicines is shown in Fig.2 (Ramakrishappa, 2002). Around 70 % population in India relies on AYUSH systems for primary health care. Around 70 % of India’s medicinal plants are found in tropical areas mostly in the various forest types spread across the western and eastern ghats, the Vindhyas, Chotta Nagpur plateau, Aravallis and Himalayas. Although less than 10 % of the medicinal plants are found in the temperate and alpine areas and higher altitudes, they include species of high medicinal value. The studies also showed that a larger percentage of the known medicinal plants could be found in the dry and moist deciduous vegetation as compared to the evergreen or temperate habitats.

Analyses of medicinal plant types indicated about 34 % are trees, another 34% are shrubs and the remaining 32 % are composed of herbs, grasses and climbers. A very small portion of medicinal plants belong to lower plants like lichens, ferns algae, etc. while majority are classified as higher flowering plants. Of the 386 families and 2200 genera of medicinal plants recorded in India, the families *Asteraceae*, *Euphorbiaceae*, *Laminaceae*, *Fabaceae*, *Rubiaceae*, *Poaceae*, *Acanthaceae*, *Rosaceae* and *Apiaceae* comprise the largest proportion of medicinal plant species, with the highest number of species falling under *Asteraceae*.

About 90 % of medicinal plants used by related industries are collected from the wild. While over 800 species are used in industries, less than 20
species of plants are under commercial cultivation. At present, 95 % of medicinal plants collected are from the wild. Some of the plant species used for medicinal purpose in India is given in the following Table 1.

Plants are available for modern medicine in four basic ways.

1. They are used as sources of direct medicinal agents.
2. They serve as a raw material base for elaboration of more complex semi synthetic chemical compounds.
3. The chemical structure derived from phytoconstituents can be used as models for new synthetic compounds.
4. They are used as taxonomic markers for discovery of new therapeutic compounds.

Though several plant species are used for therapeutic purpose in different medicinal system the knowledge of the use of plants belonging to Mulluginaceae family is rarely reported. Such report does not indicate the biological activity of these plants. However the Gisekia plant of this family has been reported to be used in the folk medicine (Jeffrey 1961), is yet to be supported by scientific study. In the vegetative part of Gisekia pharnaceoides several phenolic acids such as p-hydroxy benzoic acid, caffeic acid, p-cumaric acid and vannilic acid have been reported to be identified. In the seed, the tannin-like principles namely α-gisekia and β-gisekia have been reported to be present (Gilbert 1993). Studies on the pharmacognocy of the leaf of Gisekia pharnaceoides were carried out by Musa et al. (2006) to determine
micro and macroscopical characters and also some of its physical constants. Presence of betacyanin a compound responsible for red colour in the stem and the leaf of *Gisekia pharnaceoides* and *Giskia Africana* were reported to be demonstrated by Mabry *et al.*, (1976). These investigators have analyzed the stem and leaf by transmission electron microscope and reported the presence of sieve elements plastisids.

*Gisekia pharnaceoides* was also reported to contain non-reducing carbohydrate as detected by chromatographic and electrophoretic techniques. (Greenway *et al.*, 1953). They family *Mulluginaceae* family consists of about 14 genera and 120 species. The plants are aromatic trees, shrubs and herbs and are distributed throughout the warm and temperate region of the world, being most abundant in South Africa and Arabia. Leaves are simple alternate and rarely opposite. A number of plants of Mulluginaceae are of medicinal value (Keay 1954) Example, *Mullgo nudicaulis* used as purgative, *Mullugo cerviana* used as diuretics and *Glinus lotoides* used as anthelmintic.

*Gisekia* is a genus of about 7 species of shrubs; which mainly grow in South Africa (Hutchinson 1968; Narayana 1988), few in China and Arabia. Three species are known to grow in India of which two are economically important. The *Gisekia pharnaceoides* leaf is eaten as a vegetable to treat asthma, i.e in Somalia, Kenya and Tanzania. In West Africa leaves are rubbed on swelling and in Tanzania the stem pounded in butter, is placed on aching muscles. In India, plant sap is used against warts. The seeds probably possess anthelmintic property. (Burkill 1985 and 2000).
Even though *Gisekia pharnaceoides* has lot of potential medicinal uses, study on the chemistry of the plant extract is very scarce. The present study was undertaken with the following objectives.

1. To carry out the pharmacognostic characterization of *Gisekia pharnaceoides*.

2. To isolate the bioactive compounds from the whole plant of *Gisekia pharnaceoides* and to identify the compounds using different spectral methods.

3. To assess the nutraceutical potential of *Gisekia pharnaceoides*.

4. And to find out the following pharmacological activities of the crude extracts.
   - Anti inflammatory activity
   - Analgesic activity
   - *In vitro* anti oxidant activity
   - Wound healing activity
   - Anthelmintic activity

Hence in this investigation, the pharmacognostic, phytochemical, pharmacological and the nutritive value of the plant were examined and reported in this thesis; with a view to exploit the *Gisekia pharnaceoides* more effectively for therapeutic applications as well as in human nutrition.
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