II. Review of Literature
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Man has been depending on the use of plants as a source of medicine since time immemorial. Traces of plants unearthed at the various archeological sites show the dependence of the prehistoric human societies on plants. Phytoliths and starch grains of 2800–2400 B.C were reported from an excavation site at Ecuador (Chandler-Ezell, et al., 2006). Medicinal plants were even believed to have utility in the afterlife of the Egyptian Pharaohs. These plants have been recorded from the Gaza Pyramids (Anna, 1993). Traditional Chinese medicine developed before the birth of Christ and it also makes the use of a wide variety of medicinal plants for the treatment of various diseases (Tang and Eisenbrand, 1992; Chan, 1995; Cheng, 2000; Yuan and Lin, 2000; Bhuiyan et al., 2003; Wang et al., 2003; Lazar, 2004).

Earliest mention of medicinal plants in India has been found in the Rig Veda, written in between 4500-1600 BC. Indian classical Medicinal Texts like the Ayurveda written in about 1000 B.C. also mentions use of over 700 medicinal plants (Rabe and Van Staden, 1997). Sushruta Samhita, which was written not later than 1000 BC also contains a comprehensive chapter on therapeutics. Charak Samhita written in about the same period gives a remarkable account of phytomedicine known to the ancient Hindus. Out of about 2000 items recorded in the ancient Indian medicinal texts, less than 200 are of animal and mineral origin, the rest all others being derived from plants (Chopra, et al, 1956).

There is wide evidence of the use of medicinal plants in the traditional systems. Primitive human societies have been depending on plants and plant products for various remedies. In certain areas these folk medical prescriptions are endemic and have survived through ages from one generation to the next through verbal transmissions (Tiwari and Agrawal, 2009). The branch of science dealing with the use of plants by the ethnics is known as Ethnobotany. The ethnic system of medicine has
developed through ages by assemblage of experiences of several generations with combination of traces of Ayurvedic and Yunani systems of medicine (Mokat and Deokule, 2006). This offshoot of Ethonobotany is called Ethnomedicine. In the recent years, over 13,000 plants of ethnomedicinal importance have been studied (Dhanukar, et al., 2000). Ethnobotany is a comparatively recent branch of science dealing with the utilization of plants by the ethnic communities. Primitive human societies have been depending on plants and plant products for various remedies.

The WHO (World Health Organization) currently encourages, recommends and promotes low cost, comparatively safe and culturally acceptable traditional remedies in national health care programs worldwide. WHO, in a number of resolutions has emphasized the need to ensure quality using modern techniques and applying suitable standards. The purpose to standardize a traditional drug is to ensure efficacy and safety (De Britto, et al, 2007).

Based on the importance of pharmacological activity plants could be classified as nutraceuticals and phytochemicals. Nutraceutical properties are the health beneficial properties of the food product (Ravishankar and Mudgil, 2004). Phytochemicals on the other hand are the non-nutrient chemical components from plants effective in combating several diseases (Srinivasan, 2007). There are several of nutraceuticals and phytochemicals which are a major constituent of the herbal medicine of all ethnic groups in India and around the world. Phytochemicals are also known to act as hormones, in certain cases. Phyto-oestrogens for example, are known to reduce the risk of breast cancer even in post-menopausal women (Arif, 2006).

Traditional knowledge is validated by both the in vitro and in vivo techniques. For example, much of the traditional uses of guava (Psidium guajava L.) have been validated by toxicity studies in mice and other animal models as well as controlled human studies (Lozoya, et al, 2002). Compounds of
medicinal value are extracted from plants and chemically analyzed. Then computational methods are used to design the drug from the compound isolated (Uma and Sathyanathan, 2004), a procedure called Computer Aided Drug Designing (CADD).

Ethnomedicinal plants have been used in different formulations in different forms of treatment. Some plants are common to several forms of herbal medicine. Fenugreek seeds (Trigonella foenum-graceum) for example, have been reported in both Ayurvedic and Unani Medicine to have significant health effect (Mathur and Mathur, 2006). Another plant common to the Ayurvedic, Unani, Homeopathic and Allopathic literature is the Curry plant (Murraya koenigii) (Mandal and Parui, 2007). ‘Pippali’ and ‘Pippalimula’ from Piper longum (fruiting spikes and roots) has been used in dyspepsia, cough and diarrhoea. The formulations are also available in Ayurveda and Unani systems of medicine in addition to the traditional and folk cultures (Singh, et al, 2004). Terminalia arjuna common to both Ayurvedic and tribal medicinal systems is used in a wide range of diseases (Singhi, et al., 2008). Other such plants include Garcinia indica (Mishra, et al., 2006) and Semecarpus anacardium Linn., which are common to different systems of medicine (Chopra, et al., 1956; Pandey and Chunekar, 1967; Arulkumaran, et al., 2007 and Sowmyalakshmi, et al., 2005). Another report on clove mentions the use of the plant by the Egyptians to strengthen respiratory system; bark decoction is widely Swahili people as a remedy to diarrhoea. Clove oil is also used by people of Paraguay for treatment of gout (Naha, 2008). Grape has been praised for its medicinal value since long. Every part of the grapes plant (Vitis vinifera) has medicinal properties. These are applicable in diseases like diarrhoea, menorrhagia, hemorrhoids, arthralgia, bronchitis, hepatopathy, anaemia, gastrointestinal disorders, skin and eye troubles, etc. Flavonoids in purple grape (Vitis labrusca L.) are cardioprotective in nature (Ravindran, 2007). Several Ayurvedic herbal preparations have also been found to be a combination of several compounds. Some of these include, Trasina, for
Alzheimer’s disease (Bhattacharya and Kumar, 1997; Kumar, 2002). Sandhika, having antioxidant properties in vitro (Chaurasia, et al, 1995); a group of eight drugs known as Ashtwarga in preparing a number of rejuvenating tonics (Kumar, 2007). Rutin a flavonoid from Sophora japonica has the potential to prevent coronary artery ligation (Chopra and Singh, 1994).

Widespread uses of medicinal plants have been recorded from all over the world. In the Africa, the root, stem and leaves of Vitellaria paradoxa (Fam. Sapotaceae) have wide use in ethnomedicine (Ndukwe, et al., 2007). A combination of medicinal plants (calendula, elder, and pansy) has high anti-inflammatory activity (Gorchakova, et al., 2007). Xylopia quintassi is used by the West African tribes against rheumatism, stomach troubles and waist pains (Burkhil, 1985). In Nepal also 21 spices of plants have been recorded which find a wide range of applications in ethnomedicine (Bhattarai, et al, 2006). Oaks (Quercus spp.) are used widely in North American ethnomedicine for a wide range of diseases ranging from ordinary stomach troubles to gonorrhea, skin diseases and even piles (Purohit, 2007). Rhodiola rosea has been valued in traditional medicine in Eastern Europe and Asia since long for its various uses in herbal medicine (http://herbmaster.us/Golden_Root.html, 2008). Considered to be a delicacy since long, oyster mushrooms (Pleurotus sp.) are also used in traditional medicine of Meso-America and Mexico. It is supposed to be an efficient remedy for a wide range of diseases (Guzman, 1994; Eisenhut and Fritz, 1991). Besides, several other forms of herbal medicines have been reported from the traditional healers of Amazon (Sandoval, et al., 2002; Desmarchelier, et al., 1997), the Albanians of Lepushe, (Pieroni, et al., 2005) and traditional medicine of Togo (A.C.C.T., 1989); Rwanda (Neuwinger, 1996), China (Rao and Rao, 2006), Mexico (Alonso-Castro, et al., 2010) and Thailand (Tewtrakul and Isharat, 2006).

India is a vast repository of a wide variety of ethnomedicinal plants. In India, over 93 plants are reported to be used in 40 patented and proprietary multi-ingredient plant formulations (Sharma et
Ethnic groups, and hence the plants of ethnomedicinal importance have their distribution all over India. Ladakh, the Cold Desert of India has a total of 425 plant species used by the local herbal doctors (or Amchis). Some of the important medicinal taxa of this region are *Podophyllum hexandrum*, *Aconitum heterophyllum*, etc., (Sharma et al., 2006). A recent study has revealed that 281 spp. of 108 fauna of the Darjeeling Himalayas are of ethnobotanical importance (Chhetri, et al., 2005). A few other plants reported by different workers having widespread ethnomedicinal importance include *Ageratum conyzoids* (Sisodia and Siddiqui, 2007), *Chelidonium majus* (Biswa, et al., 2007), Harsinghar (*Nyctanthes abortristis*) (Bhatia and Ahluwalia, 2006). Several spices are also known to have ethnomedicinal properties. Some of the important plants include ginger (*Zingiber officinale*) (Lantz, et al., 2007), turmeric (*Curcuma longa* L.) (Lantz, et al., 2005), Red pepper (*Capsicum annum*) (Srinivasan, 2007).

*Nepenthes khasiana* (pitcher plant) growing in the Meghalaya hills is used as a cure to cholera. *Utricularia stellar* Linn. is used in Bihar against cough. *U. bifida* is used in Chota Nagar against urinary diseases (Singh, 2005). Almond (*Amygdalus communis*) and almond oil is known in the traditional medicine as cure to bronchitic diseases, nephric pains, etc., (Manzoor, 2006). Figs (*Ficus spp.*) have 80 spices occurring in India of which all have ethnomedicinal importance. The bark is useful in diseases of blood, vagina, uterus, scabies, in bone fracture, etc., (Bhatt and Vashistha, 2007). Fruits of sal (*Shorea robusta*) are also believed to have medicinal value (Rawat, 2005). Tea (*Camellia sinensis*) has long been used in the traditional medicine for unsettled digestive systems and as a stimulant, astringent and to improve human health in folk medicines of India and several other countries (Jha and Kizvi, 2006).

North Eastern India is the abode of approximately 225 tribes, out of 430 in the country (Chatterjee, et al., 2006). It is reported that the North eastern states having, about 47% forests, contain rich
medicinal flora (Farooq, 2005). A study reported 33 medicinal plants of 24 families used by the Zeme Nagas of North Cachar Hills district of Assam, India (Tamuli and Saikia, 2004). Survey on ethnomedicinal plants of Meghalaya during 1999-2002 reported 46 ethnomedicinal plants belonging to 44 genera and 34 families (Dolui, et al., 2004). Another study has reported several ethnomedicinal plants among the rural people of Dibrugarh district of Assam for cure of about 18 different diseases. These include, anorexia, breast-ulcer, burning micturition, burn injury, diabetes, dysentery, eczema, gout, hydrocele, jaundice, etc., (Kalita and Surajit, 2004).

Although wide research has been and is being done on Indian ethnomedicine, very little work as so far being done in this regard on ethnomedicinal plants of Tripura. Tripura however has a vast potential in this aspect. A large number of plants of ethnomedicinal importance are used by the nineteen tribes of Tripura. More than 200 species of medicinal plants are found growing in Tripura state that require conservation. These plants are being lost due to lack of awareness and deforestation (Sharma, 2009).

**Liver and Hepatoprotectivity:** The liver is an organ of paramount importance. It plays a significant role in the metabolism and disposition of the chemicals. Impairment of liver function is generally caused by xenobiotics, excessive exposure to various pharmacological and chemical agents, alcohol and protozoan or viral infections (Ibrahim, et al., 2008).

Hepar, in Greek means liver. Hepatoprotective thus means liver protecting. Disturbances in the normal functioning of the liver may ultimately result in a diseased liver which could even prove to be fatal. Various ailments of liver include liver enlargement or hepatomegaly, liver cancer, blood disorders, infections in liver like hepatitis, cirrhosis of liver, etc., (http://www.herbalcureindia.com/liver-enlargement.htm, 2008). A diagnosis of liver disease is
suggested by various signs and symptoms like loss of appetite, fatigue, jaundice, occasional vomiting, and mild fever. Among the diseases that can affect the liver the most common is hepatitis (a viral infection of the liver). Hepatitis can be caused by drugs, viruses, bacteria, mushrooms, parasites like amoebas or giardiasis, and liver flukes from dogs or cats (Sodi, 1998). The most common hepatitis viruses affecting the liver are Hepatitis A, Hepatitis B, Hepatitis C, Hepatitis D, Hepatitis E, and Hepatitis G (Hota, 2003).

Despite the tremendous advances in allopathic medicine, herbal drugs have been playing an important role in health care programs worldwide. Unlike the rest others, the herbal medicines do not tend to show any adverse side effects, which is one of the main causes for their wide acceptance. The use of medicinal plants is becoming increasingly popular among all the social classes (Iroanya, et al., 2008). There is a revival of interest in herbal medicines for treatment of various ailments including hepatopathy (Ibrahim, et al., 2008). Medicinal herbs and the extracts prepared from them are widely used in the treatment of liver diseases like hepatitis, cirrhosis, and loss of appetite (Cupp, 1999). The compounds that are responsible for medicinal property of the plant drug are usually secondary metabolites (Malhotra and Singh, 2008). Hepatoprotective plants like *Silybum marianum*, *Picrorhiza kurroa*, *Andrographis paniculata*, *Phyllanthus niruri*, and *Eclipta alba* etc., have shown genuine utility in liver disorders [Bisset (ed), 1994].

The use of natural remedies for the treatment of liver diseases has a long history. About 150 compounds from 101 different plants have been claimed to possess liver protecting activity in Ayurvedic medicine (Mishra, et al., 2009). In spite of the availability of more than 300 hepatoprotective preparations from over 87 Indian medicinal plants, only four terrestrial plants have been, so far scientifically elucidated while adhering to the internationally acceptable scientific protocols. These include *Silybum marianum*, *Glycyrrhiza glabra*, *Phyllanthus amarus* and
Picrorhiza kurroa as hepatoprotective plants (Thyagarajan, et al., 2002). Scientific research has now proved the potential of several other plants as hepatoprotective agents.

Several plants have been reported by the traditional healers to have hepatoprotective activity. Examples include Acacia concinna DC., Aganosma dichotoma (Roth) K.Schum., Amaranthus blitum Linn., Crinum asiaticum Linn., Cucumis trigonus Roxb., Achras zapota Linn., etc. Among these, Aloe perryi Baker, Aporosa lindleyana Baill. Argemone mexicana Linn. have been reported against jaundice. Crocus sativus Linn. and Dorema ammoniacum D. Don have been reported to be useful in cases of liver enlargement. Aphanamixys polystachya (Wall.) Parker, Apium graveolens Linn. and Croton oblongifolius Linn. have been report be useful in various cases of liver troubles (Chopra et al, 1956). Hepatoprotective plants have also been reported among the Gaddis of Himachal Pradesh. For example, maize grains are used in cough. Mustard oil in backache, decoction of cardamoms and carom seeds in fever (Bhasin, 2008). In Andhra Pradesh, ethnomedicinal remedy for jaundice involves an infusion of Boerhaavia diffusa and Emblica officinalis and fresh leaf juice of Evolvulus alisnoides (Abbas Ali, 2003). The tribal people of Maharashtra chew the leaves of Ficus carica as a treatment for jaundice (Gond and Khadabandi, 2008). The hepatoprotective property of Cleome viscosa Linn. used in the traditional medicine of Bundelkhand has been also established in the laboratory experiments (Gupta and Dixit, 2009). 27 hepatoprotective plants have been reported from the ethnic communities of the Aravalli ranges of Gujarat (Pujani and Kumar, 2003).

Potential hepatoprotectity has been reported from Silibum marianum, Andrographis paniculata and Glycyrrhiza glabra, (Malhotra and Singh, 2008). Phyllanthus amarus Schum and Thonn. is a very important medicinal plant and has focused as a hepatoprotective plant in curing Hepatitis B in modern research (Rai and Mehrotra, 2008). Cynara s colymus (common artichoke) (Taylor, 2000),
Pelvetia siliquosa Tseng et Chang (Lee, et al., 2002), Solanum nigrum and Cichorium intybus (Sultana, et al, 1995) have also been reported for their hepatoprotective activity.

The aerial parts of Chelinodium majus are used to cure jaundice by the Albanians of Lepushe (Pieroni, et al., 2005). Medicinemen of southern Italy are known to use Nasturtium officinale as a cure for jaundice (Guarrera, et al., 2005). Both fresh and dried rhizomes of Musa paradisiaca are used for treatment of jaundice in the ethnomedicinal practice of Paraguay (Basualdo et al., 1991). Cochlospermum tinctorium is used for the treatment of jaundice in Mali (Negрад, et al., 2005).

Several hepatoprotective plants have also been reported amongst the Sonowal Kacharis of Upper Assam. Papaya (Carica papaya), and banana (Musa paradisiaca) are valued by these people as valuable cures to liver ailment. Saccharum officinarum, Averrhoa carambola, Emblica officinales, Azadirachta indica, Leucas aspera, Herpestes monniera and Musa sapientum are the prescribed edibles for a jaundice patient (Das et al, 2008). Commelina bengalensis and Leucas aspera have also been reported to have anti-bilous properties amongst the Nath people of Assam (Sikdar and Dutta, 2008).

Extracts from different plant species have been found to show hepatoprotective property in both in vitro and in vivo systems. Chloroform extract of Polygala arvensis leaves have exhibited a significant hepatoprotective activity in Winstar albino rats (Dhanabal, et al, 2006). Both the alcoholic and aqueous extracts of fruit pulp of Lichi chinensis have been found to show significant hepatoprotective activity in carbon tetrachloride induced hepatotoxicity, the aqueous extract being more effective than the alcoholic extract (Souza, et al., 2007). The aqueous extract of Adansonia digitata exhibited significant hepatoprotective activity against chemical toxicity with CCL4 in rats (Al- Qarawi, et al., 2003). Ethanol extract of Pisonia aculeata showed a remarkable
hepatoprotective and antioxidant activity against carbon tetrachloride (CCl₄)-induced hepatotoxicity (Palanivel, et al., 2008). 1-DNJ derived from Morus alba L, was found to suppress the secretion of HBV particles in a dose dependent manner (Jacob, et al., 2007). Besides, 2-arylbenzofuran derivatives from Mori cortex radicis have been found to show anti- HCV activity in an HCV replicon system (Wohlfarth and Efferth, 2009).

Jigrine, a Unani polyherbal formulation of the aqueous extracts of 14 medicinal plants exhibited significant hepatoprotective activity against galactosamine induced hepatotoxicity (Najmi, et al., 2005). Bacoside-A from Bacopa monniera was found to show hepatoprotective effect against d-GalN induced hepatotoxicity in rats (Sumathi and Nongbri, 2008). In another study aqueous extract of Psidium guajava showed remarkable hepatoprotective activity against carbon tetrachloride, paracetamol and thioacetamide induced acute hepatotoxicity in experimental animals(Roy et al, 2006).

Oroxyllum indicum (L.) Vent. as a herbal remedy: Oroxyllum indicum (L.) Vent. has been known in the traditional systems of medicine since long. The plant was prescribed by Charaka and Sushruta internally for persistent dysentery, non- healing ulcers, and gynecological disorders, as an antiseptic, antitoxic and styptic. It was also applied for adhesion of fractured bone. The paste of leaves was applied in the falling of hair and baldness. In addition to these, the plant was also administered in the treatment of diarrhoea and abdominal diseases, rheumatism, diseases of ear, throat and nose, high fever, partial paralysis, diabetes and dysuria. The tender leaves and fruits were used as stomachic and purgative; the leaves were used externally for enlarged spleen, headache and ulcers [Khare (ed.), 2004].
Root bark of *O. indicum* is a traditional remedy for fever, bronchitis, intestinal worms, leucoderma, asthma, inflammation, anal troubles, etc. Fruits and seeds of the plant are expectorant, purgative and bitter tonic (Kirtikar and Basu, 1996; Kalkunte, *et al.*, 2006; Satyan, *et al.*, 2006). The plant is also administered as tonic and astringent, in diarrhoea, dysentery and rheumatism. Tender fruits are refreshing and stomachic. Seeds are purgative (Tiwari, *et al.*, 2007). The plant is also known to have immunomodulatory property as well as antioxidant potential (Zaveri, *et al.*, 2006). Bark powder of the plant is used with *Mucuna pruriens* DC. to treat cuts and burns by the Akha tribesmen of Thailand. The plant also finds use as an abortifacient and in childbirth by these people (Anderson, 1986). The plant is used for the treatment of abdominal tumors in Asian folk medicine (Soe and Myo Ngure, 2004). It was also reported to possess anticancer properties (Lambertini *et al.*, 2004; Costa-Lotufo *et al.*, 2005).

In India, *O. indicum* is used by the tribals of Ratangiri district, Maharashtra against jaundice (Mokat and Deokule, 2006). Seeds of the plant are pounded into flour and consumed by the people of Baster district of Madhya Pradesh (Jain, 1963). The seeds and bark are used medicinally for alleviating pain and as an antiphlogistic medicine (Anonymous, 2009). Decoction of the bark is used as a potent anticancer medicine, especially against nasopharyngeal cancer in Maram Naga village of Senapati district, Manipur (Mao, 2002). The ethnomedicine of North Eastern India records the plant for diarrhoea, dysentery and rheumatism (Kumar, 1999).

Inspite of the obvious success of the natural products approach towards drug discovery, in recent years it has lost some favor, especially within the pharmaceutical industry (Raskin, *et al.*, 2002). However, people have now begun to realize that the move to discontinue natural products research might have been a mistake. The approach of drug discovery through natural products research has proved to be the single most successful strategy in this regard (Kingston, 2005). However,
thoughtful and judicious use of the medicinal plant resource for natural product research is the need of the day as indiscriminate collection of medicinal plants will destroy their existence like any other natural resource (Larsen, 2005).