1.1 INTRODUCTION

Nature is used as source of medicinal agents since times immemorial. Plants are source of medicine has been an ancient practice and becomes an important component of health care system in India. India is leading producer of medicinal herbs so it is called as botanical garden of the World. The natural constituents of plant are derived from any parts of plant like leaves, roots, bark, flowers, fruits and seeds i.e., active components can be present in any parts of the plant. Plants used for traditional medicine contains wide variety of substance which are used for the treatment of infectious and as well chronic diseases. A knowledge of how plants are used against different illness are expect to accumulate in areas where use of plants are still of great importance.

Based on World Health Organization (WHO), more than 80% of population depends on traditional medicines for needs of their primary health care in the World. Medicinal plants are rich source for traditional system of medicine, nutraceuticals, modern medicine, supplements for food, folk medicine, intermediate of pharmaceuticals and chemical entities for synthetic drugs. Medicinal value of plants depends on some chemical compounds which produce significantly important physiological action on human body. The medicinal effect of plant material results from combination of secondary metabolites present in plant. The most important bioactive secondary metabolites in plants are alkaloids, flavonoids, tannins and phenolic compounds.

Plants have a great potential effect to produce a new drug for great benefit to mankind. In higher plants, there are many approaches for the search of new
biologically active principles\(^5\). Further, scientific investigation and information of
the plant material that are therapeutically potential is limited. There is increasing
needs for more and more drugs from plant source because recently a newly
growing interest in traditional medicine is noticed. The growing interest for drugs
derived from plant is mostly due to increasing wide spread belief is “green
medicine” is more safe than synthetic drugs that are very costly and have
unfavorable side effects.

For management of serious human illness the importance of herbs cannot
be over-eminized. Plant kingdom harbors is the Important source of active
ingredients invaluable in management of many intractable diseases. Further, active
components of herbal remedies have capacity to combine with many other
substances that are inactive.

Herbs are used for variety of domains such as cosmetics, smoking,
medicine, dyeing, fragrances, nutrition, repellents, flavoring and beverages and for
other industrial purposes. Since prehistoric era, important basis for almost all
therapy in medicine is herbs until synthetic drugs are developed in 19\(^{th}\) century\(^7,8\).

Many medicinal plants contains huge amount of antioxidants such as
polyphenols that plays a important role in quenching singlet and triplet oxygen,
adsorbing and neutralizing free radicals or decomposing peroxides. Most
phytochemical have significant antioxidant capacity and in several human diseases
decrease the mortality rates\(^9\).

Herbal medications are popular due to low incidence of adverse effects
to plant preparation compounds to pharmaceuticals\(^10\). Investigations of
phytochemical is carried out during 1970’s and 1980’s and discovered various alkaloids and other pharmacologically active compounds which are studied presently and also possible to serve as models for new synthetic compounds\textsuperscript{11}.

One of the important parameter for authenticity, safety, quality and efficacy of herbal products is botanical identification of microscopic, macroscopic, taxonomic, organoleptic, powder analysis studies\textsuperscript{12}.

The use of medicinal plants as potential sources of antimicrobial compounds, it is important to investigate their activity and composition and their use is validated\textsuperscript{13}. Few phytochemicals produced by plants possess antimicrobial activity and it is used for development of new antimicrobial drugs\textsuperscript{14}. Many plants possess antimicrobial activities and are used for the treatment of different diseases\textsuperscript{15}. In recent years, medicinal plants with antimicrobial properties are being greatly reported from different parts of the World\textsuperscript{16}. There is increased awareness for correlating phytochemical compounds of medicinal plants with pharmacological activities\textsuperscript{17}.

1.1.1 Hepatoprotective activity

Liver diseases treated with herbal drugs are a long tradition in China, India and Japan. Approximately 170 phytoconstituents derived from 110 plants which belong to 55 families are reported to have hepatoprotective activity. All over the Globe, about 600 herbal formulations with hepatoprotective activity are commercially sold. In Indian market there are around 40 patented polyherbal formulations which represent a variety of 93 Indian herbs combination from 44 families are available\textsuperscript{18}. Some herbal preparations occur as standardized extracts

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with major known ingredients or pure compounds. High consumption of vegetables and fruits leads to reduced risk of liver diseases that is due to antioxidant vitamins and other phytochemicals\textsuperscript{19}. In edible plants, there is increased deal of interest which contains antioxidants and health promoting phytochemical with respect to health implications. Several plants have been studied for their hepatoprotective activity.

Hepatoprotective activity of Aloe barbadensis Mill was studied against CCl\textsubscript{4} induced hepatotoxicity. It was evident that alkaline phosphatase, serum transaminases, glucose-6-phosphatase, triglycerides and bilirubin, glutathione, lipid peroxidation, amidopyrine N-demethylase and microsomal aniline hydroxylase were restored to nearly normal levels after extract administration\textsuperscript{20}.

Hepatoprotective activity of extract of Croton oblongifolius Roxb (Euphorbiaceae) and Apium graveolens Linn (Apiaceae) were investigated. The extent of liver protection was measured by using the activity of SGOT, SGPT and ALP. The extract significantly reduced the activity of above mentioned parameters\textsuperscript{21}.

Hepatoprotective activity of ethanolic extract of Beta vulgaris roots at various doses 1000 mg, 2000 mg and 4000 mg/kg bwt given orally in carbon tetrachloride induced hepatotoxicity in rat significantly showed dose dependent protective action. Hepatoprotactivity was assessed by serum markers such as alkaline phosphatase and transaminases and levels of triglyceride and cholesterol\textsuperscript{22}.

The n-heptane extract of leaves of Cassia fistula leaves was investigated for hepatoprotective activity in CCl\textsubscript{4}; liquid paraffin (1:1) induced hepatotoxicity in rats.
The extract possessed protective effect by significantly reducing the activity of serum alkaline phosphatase, and transminases (AST and ALT) and bilirubin levels\textsuperscript{23}.

Ethanol extract of Solanum nigrum L was investigated for hepatoprotective activity in carbon tetrachloride induced hepatotoxicity in rats. Hepatoprotective activity was assessed by determining the activities of ALP, ALT, AST and total bilirubin level which possessed remarkable hepatoprotective activity\textsuperscript{24}.

The juice of leaves of Kalanchoe pinnata Pers. and ethanolic extract of marc left after extracting juice were studied in carbon tetrachloride induced hepatic damage in rats. Extract was found to possessed effective hepatoprotective activity and it was proved by in vitro, in vivo and histopathological studies. Juice was found to be more effective as compared to ethanol extract\textsuperscript{25}.

Aqueous and methanolic extract of fruits and leaves of Phyllanthus niruri were investigated for hepatoprotective potential and antioxidant activity. CCl\textsubscript{4} induced hepatotoxicity in rats was evaluated by raised activity of serum enzymes ALT and AST which was prevented by pretreatment with extract and proved the hepatoprotective action of Phyllanthus niruri\textsuperscript{26}.

Ethanolic extract (50\%) of whole plant of Amaranthus spinosus was evaluated for antioxidant and hepatoprotective activity in CCl\textsubscript{4} induced hepatotoxicity in rats. Elevated activities of serum enzymes like alkaline phosphatase, aspartate transaminase, alanine transaminase and total bilirubin level were significantly returned to nearly normal levels by Amaranthus spinosus in dose dependent manner\textsuperscript{27}. 

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Aqueous extract of Ballota glandulosissima (Lamiaceae) was investigated for hepatoprotective and anti-inflammatory activity. Treatment with extract showed significant decrease in the activity of serum transferase\textsuperscript{28}.

1.1.2 Antidiabetic activity

Diabetes mellitus is recently one of most burdensome and costly chronic diseases. It is a condition that increasing in epidemic proportions throughout the World. Diabetes is a serious illness with several complications and premature mortality which accounts approximately 10\% of total health care expenditure in many countries\textsuperscript{29}. The prevalence of diabetes is found to increase from 171 million in 2000 to 366 million in 2030 for all age groups in Worldwide\textsuperscript{30}. DM is a severe and health growing problem in most countries. It causes variable degree of premature mortality, disability and loss of productivity and also raised demands on health care facilities. The literature available shows that there are more than 400 plant species possessing hypoglycemic activity and several laboratories are involved in isolation of new herbal hypoglycemic agents\textsuperscript{31,32}.

Antihyperglycemic and hypoglycemic activity of aqueous extract of Aegle marmelos root in normal and diabetic rats were evaluated\textsuperscript{33}. Extract administration at dose of 250 mg/kg was found significantly effective and after 6 hour of administration it reduced the level of blood glucose in normal healthy rats by 35.1\%. The blood glucose level was markedly decreased by 41.2\% and 33.2\% in sub and in mild diabetic rats respectively in GTT after 2 hour at same dose. It also restored triglycerides, total cholesterol, HDL and LDL levels. The results clearly proved that aqueous extract of Aegle marmelos seed having antidiabetic and hypolipidemic activity on diabetic rats.
Administration of eremanthin of various doses (5, 10, 20 mg/kg bwt) for 60 days to streptozotocin induced diabetic rats significantly decreased the level of plasma glucose in dose dependent manner than control rats. In addition, administration of eremanthin (20 mg/kg bwt) orally reduced serum triglyceride, total cholesterol, LDL-cholesterol and glycosylated hemoglobin (HbA1c) significantly and at same time markedly increased serum protein, plasma insulin, HDL-cholesterol and tissue glycogen. Eremanthin also restored plasma enzyme activities like acid phosphatase, alkaline phosphatase, lactate dehydrogenase, alanine transaminase, aspartate transaminase to nearly normal levels\textsuperscript{34}.

Aqueous extract of fruit of Diospyros peregrina was studied in streptozotocin–nicotinamide induced type II diabetes in rats. Administration of extract at dose of 50 and 100 mg/kg bwt per day orally to diabetic rats for 28 days was found to possess significant hypoglycemic and hypolipidemic activity in dose dependant manner\textsuperscript{35}.

Eleven Indian medicinal plants having antidiabetic activity were investigated in STZ induced diabetic rat which provided scientific validation to prove its antihyperglycemic activity\textsuperscript{36}.

The chloroform extract of roots of Andrographis paniculata was evaluated for antihyperglycemic activity in alloxan induced diabetic rats by acute and chronic studies\textsuperscript{37}. The blood glucose levels were significantly decreased in both acute and chronic studies. The chloroform extract of Andrographis paniculata roots showed antidiabetic activity significantly that supported the traditional use of plant by Ayurvedic physicians for diabetes control.
Cyperus rotundus was used to treat diabetes and investigations were done for antidiabetic effect in alloxan induced hyperglycemic rats. Administration of 500 mg/kg of extract daily for seven consecutive days orally reduced the level of blood glucose significantly. This antihyperglycemic activity may be caused due to its antioxidant activity which was proved by strong in vitro DPPH radical scavenging activity.\textsuperscript{38}

Ethanolic extract of stem bark of Terminalia arjuna at dose of 250 mg and 500 mg/kg bwt in alloxan induced diabetic rats for 30 days was investigated and its histopathological study was studied in liver, kidney and pancreatic tissues.\textsuperscript{39} The effect of administration of Terminalia arjuna orally at dose of 500 mg / kg bwt was more effective than 250 mg/kg bwt. The result showed that the extract possessed protective effect on tissues and proved to be potential as antidiabetic agent.

Hypoglycemic activity of dichloromethane: methanol extract in ratio 1:1 of leaves and twigs of Catharanthus roseus was assessed in streptozotocin induced diabetic rat. Oral administration of extract at dose 500 mg/kg bwt for 7 and 15 days showed 48.6 and 57.6\% hypoglycemic activity respectively.\textsuperscript{40}

Administration of aqueous extract of leaves Murraya koenigii Spreng at dose 600 mg/kg bwt and methanol extract at 200 mg/kg bwt orally for eight weeks was studied in alloxan-induced diabetic rats.\textsuperscript{41} After treatment with aqueous and methanol extracts in diabetic rats showed decrease in blood glucose level significantly than control diabetic group. This suggested that hypoglycemic effect was mediated by stimulation of insulin synthesis and/or secretion of insulin by pancreatic islets of β-cells.
Antidiabetic activity of ethanolic extract of Allium sativum L. (garlic) was studied against normal and STZ induced diabetic rats. Administrations of garlic extract restored the levels of serum glucose, urea, creatinine, uric acid, total cholesterol, triglycerides and activities of ALT and AST. The action of garlic extract was compared with glibenclamide, known standard antidiabetic drug. The antidiabetic activity of garlic extract was more significant than glibenclamide⁴².

1.1.3 Antitumor activity

Medicinal plants are used all around World in daily life for many years in treatment of diseases. Drugs that are semi-synthetically prepared from natural sources or obtained from natural products correspond to 78% of new drugs which are approved by FDA between 1983 and 1994. These evidences are helpful to quantify and support the importance of natural product screening⁴³. The use of plants possesses long history in cancer treatment. Discovery of drug from plants is multi-disciplinary approach that associates several ethno-botanicals, phytochemical, botanical, chemical and biological separation techniques⁴⁴. Natural products derived from plants such as steroids, flavonoids and terpenoids etc have gained considerable attention in recent years because of their wide pharmacological properties including antitumor and antioxidant activity⁴⁵.

In vitro cytotoxic activity of aqueous ethanol extract of Coriolus versicolor on two human promyelocytic leukemia (NB-4, HL-60) and B-cell lymphoma (Raji) cell lines was studied by MTT cytotoxicity assay and also investigated whether there was apoptosis induction. Coriolus versicolor extract was found to be dose-dependently and selectively cause inhibition of leukemia and lymphoma cell proliferation mainly by apoptosis dependent pathway⁴⁶.
Methanolic extract of Hypericum hookerianum at dose of 100 mg and 200 mg/kg bwt for 10 days orally was assessed for in vivo antitumor activity in Dalton’s lymphoma ascites\textsuperscript{47}. Results showed that administration of extract increased the survival of animals, reduced the body weight induced by tumor burden and decreased the packed cell volume and viable tissue cell count and restored various hematological parameters which indicated effective antitumor effect of extract.

The possible antioxidant and antitumor activity of methanol extract of leaves of Triumfetta rhomboidea was studied against DLA bearing swiss albino mice. Treatment with METR restored viable cell count; tumor volume thereby increased the life span of DLA bearing mice. METR also restored the hematological parameters\textsuperscript{48}.

The antitumor activity of two different doses of aqueous and ethanol extracts of whole plant of Drosera burmannii Vahl against Dalton’s ascites lymphoma model was evaluated by survival time (increased life span), packed cell volume, peritoneal viable cancer cell count, body weight and hematological parameters, lipid profile, hormone level, serum enzyme activity, assay of RNA, DNA, Caspase-3 and total protein in peritoneal fluid\textsuperscript{49}.

In vitro and in vivo anticancer activity of crude ethanolic extracts from leaves of Canthium parviflorum Lam was investigated. The in vivo study was determined in mice using Dalton’s lymphoma ascites cells. Ethanolic extract of C.parviflorum greatly inhibited DLA and Hela cell growth with $IC_{50}$ of 61.24 µg/ml and 43.15 µg/ml respectively and also increased the life span and decreased the tumor weight and cancer cell number significantly in tumor induced mice\textsuperscript{50}. 
Antitumor and cytotoxic activities of methanolic extract of Desmodium triangulare root were studied in EAC and DLA cell lines which showed effective in vitro cytotoxic activity with IC$_{50}$ value for EAC and DLA cell lines are 89 μg and 99 μg respectively. Treatment with methanolic extract of Desmodium triangulare root at dose of 50mg and 250mg/kg bw decreased the volume of development of solid tumor and increased the body weight of ascites tumor significantly. This indicated that in vitro antitumor and cytotoxic properties of Desmodium triangulare showed its potential usage as anticancer agent.$^{51}$

In vitro cytotoxicity was tested for total alkaloid fraction of methanolic extract of Solanum pseudocapsicum unripe fruits against RD, HEp-2 and Vero cell lines and antitumor activity was assayed by HEp-2 and DLA cell lines. Morphological changes and viability of cell were evaluated. Short term antitumor studies by DLA cell lines showed that total alkaloid fraction shows 50% viability in concentration ranging from 6.25 to 12.5 μg/ml.$^{52}$

Ethanolic herbal extract residues of seeds of Annona squamosa Linn were tested against Dalton’s Lymphoma Ascites tumor cell. Percentage of hemoglobin and red blood cell counts of treated mice were higher than that of tumor bearing mice. The white blood cell counts of treated mice were lower than that of tumor bearing mice. This was a good index of tumor recovery.$^{53}$

In vivo anticancer activity was assessed for aqueous extract and methanolic extract of Clerodendrum serratum root at dose 100 mg and 200 mg/kg bw against DLA cell lines. The parameters like analysis of body weight, mean survival time, increased the life span in percentage, hematological and biochemical parameters were determined.$^{54}$
1.2 DECALEPIS HAMILTONII

1.2.1 Scientific classification

Kingdom : Plantae Order
           : Gentianales
Family : Asclepiaceae
Genus : Decalepis
Species : Hamiltonii

Decalepis hamiltonii Wight and Arn (swallow root) is climbing monogeneric shrub endemic to Deccan Peninsula. Decalepis hamiltonii Wight and Arn commonly called as Magali kizhangu in Tamil, Maredu kommulu in Telugu, Makali beru in Kannada and Nannari in Malayalam belonging to the family of Asclepiaceae. The roots are markedly fleshy and cylindrical (measures from 1 to 6 cm in diameter). The fresh root are brownish outside, very pale yellow inside and emits a strong aromatic aroma and tastes sweet accompanied by a tingling sensation on the tongue\(^55\). The root contains 8% woody core and 92% fleshy matter. Root of Decalepis hamiltonii are used in Ayurveda, an ancient traditional system of medicine in India to relieve flatulence, for stimulation of appetite and also used as general tonic\(^56\). It is also useful as preservative, blood purifier and as bioinsecticide source for stored food grains\(^57\). Tubers are used as pickles and also used as juice for alleged health promoting properties.

Previous studies showed that roots of Decalepis hamiltonii contains saponins, aldehyde, inositol, lupeols and amyrins\(^58\) and also volatile compounds like benzaldehyde, vanillin, 2-hydroxy-4-methoxybenzaldehyde,
2-phenyl ethyl alcohol and others\textsuperscript{59}. The roots also used in ayurvedic preparations of ancient medicine in India as substitute for Hemidesmus indicus. It possesses potent antioxidant properties\textsuperscript{60}, antiulcer\textsuperscript{61}, anti-inflammatory and antipyretic\textsuperscript{62}, gastroprotective\textsuperscript{63} activities. In addition bornerol, 14- aminotetradecanoic acid, ellagic acid, 4- (1-hydroxy-1-methylethyl)-1-methyl-1,2- cyclohexane diol, 4-hydroxyisophthalic acid, 2,4,8-trihydroxybicycle (3.2.1) octan-3-one, bis- 2,3,4,6-galloyl-α/β-D-gluco pyranoside and 2-(hydroxymethyl)-3-ethoxy benzaldehyde have been identified in swallow root\textsuperscript{64,65}.

Fig 1.1: Structure of Decalepis hamiltonii
1.3 REFERENCE


