SUMMARY AND CONCLUSION

Medicinal plants are known to be rich in secondary compounds that are widely used in traditional medicine to fight and cure several different ailments. Nature has provided us a large amount of flora and fauna. Some of the natural medicinal plants are so common that we are regularly using them in daily life without knowing their medicinal importance. Indian literature like Ayurveda and various ancient literatures use herbal remedies for number of human diseases. The healer’s consensus in treatment of main reported diseases is fairly high, gives additional validity to plants as a traditional remedy.

Ancient tribes in the Western Ghats of India use the roots of Decalepis hamiltonii Wight and Arn (Asclepiadaceae) for several medicinal purposes particularly inflammation. The objective of the present study was to carry out the pharmacognostical and phytochemical investigation and to evaluate the antibacterial, hepatoprotective, antidiabetic and anticancer potency of Decalepis hamiltonii root extract. This study thus provides new scientific information about phytochemical constituents and the biological potential of Decalepis hamiltonii root extract that has not been reported earlier.

Pharmacognostical studies

Pharmacognostical study deals with macroscopical, microscopical and physiochemical analysis of Decalepis hamiltonii. These studies were carried out to overcome the problem of misunderstanding of plant.

Physiochemical standards of ash value, moisture content, pH and extractive values were determined.
Macroscopical parameters like color, taste and smell was studied.

The microscopical constants such as cortex, secondary xylem and secondary phloem and powder microscopical observations like laticifers, parenchyma cells and starch grains were also studied.

The macroscopic as well as microscopic studies of Decalepis hamiltonii Wight and Arn revealed that by using these diagnostic features one can identify the plant easily form adulterants. The information obtained from ash values and extractive values are useful during the time of collection of root and also during extraction process. Using these standards, especially histological and chemical studies the plant can be authenticated, identified and differentiated form other related species, also these pharmacognostic parameters help in the detection of adulteration.

Phytochemical analysis and characterization

Phytochemical characterization like preliminary phytochemical screening, HPTLC analysis and compound identification by GC-MS were done.

Preliminary phytochemical analysis of various extracts like petroleum ether, benzene, chloroform, ethyl acetate, acetone, methanol, ethanol and aqueous of Decalepis hamiltonii showed the presence of flavonoids, cardiac glycosides, steroids, saponins, tannins, phenols, resins thiols and carbohydrates etc. These secondary compounds may be responsible for various pharmacological activities.

Qualitative phytochemical characterization was done by HPTLC method for petroleum ether and methanol extract of Decalepis hamiltonii. These HPTLC
studies revealed the presence of lipophilic, hydrophilic compounds, flavonoids and sesquiterpene lactones.

GC-MS analysis was done for identification of compounds in the methanolic extract of Decalepis hamiltonii. GC-MS studies revealed the presence of six different compounds like 3,7-dimethyl-undecane, 3-ethyl-5-(2-ethyl butyl)-octadecane, 2-hydroxy-4-methoxy-benzaldehyde, glycodeloxycholic acid, 3-acetoxy-7,8-Epoxylanostan-11-ol and chlortetracycline.

Antibacterial activity

Antibacterial activity of various extracts was studied against gram positive bacteria like Escherichia coli, Klebsiella pneumonia, Salmonella typhi, Proteus mirabilis, Vibrio cholera, Serratia sp and gram negative bacteria like Staphylococcus aureus and Bacillus subtilis. These studies revealed that the root of Decalepis hamiltonii showed varying degree of antibacterial activities except aqueous extract may be due to the presence of secondary metabolites.

Hepatoprotective activity

Hepatoprotective activity of methanolic extract of Decalepis hamiltonii root were studied in acetaminophen induced hepatotoxicity in rats and various parameters like serum marker enzymes like AST, ALT and ALP, bilirubin, protein, lipid peroxidation, antioxidants like CAT, SOD, GPx, GSH and Vitamin C were assayed.

Treatment of methanolic extract root of Decalepis hamiltonii significantly restored the elevated activities of aspartate transaminase, alanine transaminase and alkaline phosphatase to nearly normal levels which showed the protective
role by restoration of functional integrity of cell membrane and membrane stabilization.

Altered level of protein in serum and liver tissue was brought back to normal by methanolic extract which maintained the structural integrity of hepatic cells.

Glycogen content was also restored to normal which indicated the improvement of secretary mechanism.

Methanolic extract root of Decalepis hamiltonii also showed potent antioxidant activities. Elevated level of lipid peroxidation returned to normal after treatment with extract may be due to its antioxidant capacity.

Reduced level of enzymatic antioxidants like catalase, superoxide dismutase, glutathione peroxidase and non-enzymatic antioxidants like reduced glutathione and vitamin C in hepatic damaged rats was elevated to nearly normal after administration of extract leads to prevention of free radicals accumulation and thus protected the liver.

The results of our study showed that potent antioxidant and hepatoprotective effect of methanolic extract of Decalepis hamiltonii root was due to its free radical scavenging and antioxidant properties.

Antidiabetic activity

Antidiabetic activity of methanolic extract of Decalepis hamiltonii root were studied in normal and alloxan induced diabetic rats.
In oral glucose tolerance test, administration of methanolic extract of Decalepis hamiltonii showed significant decreased blood glucose level at 90 and 120 minutes.

The Decalepis hamiltonii extract also decreased the blood glucose level in normal rats at 2\textsuperscript{nd} and 4\textsuperscript{th} day of assessment after treatment.

Increased level of blood glucose in alloxan induced diabetic rats was also reduced to normal after administration with methanolic extract of Decalepis hamiltonii which may be due to the promotion of insulin secretion by pancreatic β-cells.

Depletion of glycogen content in diabetic rats was also maintained to normal after treatment with extract which may be due to insulin release by β-cells.

Elevated serum transaminases like AST and ALT brought back to normal after administration of extract.

Altered levels of cholesterol and triglycerides in diabetic rats returned to nearly normal which showed hypolipidemic activity of Decalepis hamiltonii which may be due to inhibition of HMG CoA reductase of cholesterol biosynthesis and activation of lipoprotein lipase for hydrolysis of triglycerides.

Conclusively, it was evident that methanolic extract of Decalepis hamiltonii root contains antihyperglycemic agents capable of lowering blood glucose level and hypolipidemic effect. The activity was confirmed by histopathological studies of pancreas.
Antitumor activity

The antitumor activity of methanolic extract of Decalepis hamiltonii root was assessed in Daltons Lymphoma Ascites model in Swiss albino mice.

Short term in vitro cytotoxicity was studied by Tryptan blue exclusion method which showed that the extract does not reduce the viability of DLA cells even at higher concentration.

In vitro cytotoxicity was assayed using two cell lines like Vero and A549 by MTT assay method. The results revealed that CTC\textsubscript{50} value for Vero and A549 are 60 µg and 215 µg/ml respectively. The methanolic extract of Decalepis hamiltonii root showed good cytotoxicity against these cell lines.

In vivo antitumor activity was done by methanolic extract of Decalepis hamiltonii root using DLA cell lines. Increased body weight due to tumor in DLA bearing mice was reduced by treatment with methanolic extract of Decalepis hamiltonii.

The extract also increased the mean survival time and percentage increase in life span which suggested the antiproliferative effect of Decalepis hamiltonii.

Hematological parameters like hemoglobin, RBC and WBC were remarkably restored to normal conditions by methanolic extract of Decalepis hamiltonii which proved hematopoietic protective activity without myelotoxicity.

Elevated activities of aspartate transaminase, alanine transaminase and level of serum protein returned to normal which showed protection to liver.
The antitumor activity of methanolic extract of Decalepis hamiltonii root was probably due to its flavonoid content.

The observed data were highly significant which demonstrate the potential antibacterial, anticancer, antidiabetic and hepatoprotective effects of Decalepis hamiltonii root. Although the results from this study were quite promising for the use of polyherbal formulations as a medicinal agent for hepatoprotective, antidiabetic and antitumor activities, several limitations exist in the current literature. Further studies should be carried out to isolate and characterize the active principles responsible for the action.