Summary

Caralluma geniculata is an endemic medicinal plant of the family Apocynaceae. Most of the plants which belong to this family were reported as herbal medicine but no authenticated reports were present in this plant. So this species was selected for the present study. The study had mainly focused on the preliminary phytochemical analysis using various polar (acetone, ethanol and water) and nonpolar (petroleum ether and chloroform) solvents. Whole plant of Caralluma geniculata revealed the presence of Carbohydrates, flavonoids, phenolic compounds, saponins, terpenoids, steroids, proteins, coumarins, quinones and phytosterols. Among the different solvents, ethanol was prefered for further studies as it was less toxic and safe for consumption.

Attempts were made to analyse the ethanol extract of Caralluma geniculata using FT-IR spectral method and identified the functional group of 19 compounds. Further, ethanol extract of Caralluma geniculata was subjected to identify the phytocomponents using GC-MS method and tentatively identified 19 major compounds. Among the different components, Methyl 2,3-di-O-acetyl-4,6-di-O-methyl-a-D-mannopyranoside showed maximum peak value (25.39%).

Anatomical features of stem revealed the presence of epidermis, cortical zone, thin layer of vascular elements and pith region, whereas root showed epidermal layer bearing several unicellular epidermal hairs, cortical zone and vascular cylinder. Anatomical features of this plant will serve to identify correct plant from adulteration.

Different in vitro antioxidant models such as free radical scavenging activity of DPPH, free radical scavenging activity on ABTS, hydroxyl radical scavenging activity,
nitric oxide radical scavenging activity, superoxide radical scavenging activity and lipid peroxidation inhibiting assay were experimented. In all the models tested the percentage of inhibition increased with increase in concentration of Caralluma geniculata extract. High dose of ethanol extract of Caralluma geniculata showed significant percentage of inhibition which is similar to the standard Gallic acid.

The IC\textsubscript{50} value for DPPH scavenging activity of ethanol extract of Caralluma geniculata was found to be 413.61 µg/ml. While, the Gallic acid showed 4.42µg/ml. The IC\textsubscript{50} value for ABT radical scavenging activity of ethanol extract of Caralluma geniculata was 177.52µg/ml. Whereas, the Gallic acid showed 9.39 µg/ml. Hydroxil radical scavenging activity of Caralluma geniculata showed the IC\textsubscript{50} value 101.30µg/ml at the same time the standard Gallic acid showed 6.26µg/ml. The IC\textsubscript{50} value for nitric acid radical scavenging activity of plant extract was 354.36µg/ml while the IC\textsubscript{50} value of Gallic acid was found to be 17.25µg/ml. The IC\textsubscript{50} value for superoxide radical scavenging activity was found to be 572.04µg/ml. Whereas, the Gallic acid showed 9.03µg/ml. Lipid peroxidation inhibiting activity of plant extract was noticed as 30.28µ/ml while the Gallic acid showed 13.37µg/ml.

In vitro anti-diabetic activity of Caralluma geniculata was examined using inhibition of α-glucosidase and α-amylase methods. Dose dependent increase in percentage of inhibitory activity was noticed in both methods. The percentage of activity was almost similar to the standard Acarbose. The present study demonstrated α-glucosidase inhibitory effect with an IC\textsubscript{50} value of 179.33µg/ml whereas the standard Acarbose showed 45.32µg/ml IC\textsubscript{50} value for α-amylase inhibitory effect of Caralluma
geniculata was 101.87µg/ml. At the same time the standard Acarbose exhibited its effect in 83.33µg/ml.

Induction of obesity by high fat diet increased the body weight, organ weight, body mass index and mesenteric fat pad weight in Wistar strain albino rats and altered the biochemical parameters. Administration of aqueous and ethanol extract at 300mg/kg bwt altered the physical changes in experimental group more or less similar to normal group.

Lipid profiles such as cholesterol, triglycerides, free fatty acids and phospholipids also showed markable changes. Administration of aqueous and ethanol extract of Caralluma geniculata at 300mg/kg bwt produced significant increase in the level of HDL cholesterol and decrease in total cholesterol, LDL cholesterol, VLDL cholesterol, triglycerides, free fatty acids and phospholipids.

The increase in serum hepatic enzyme markers such as AST, ALT, ALP and GGT in High fat diet induced obese animals decreased significantly on administration of aqueous and ethanol extract of Caralluma geniculata in a dose dependent manner.

Decrease in the level of lipid peroxide accompanied by the increase in the level of antioxidant enzymes such as reduced glutathione, glutathione peroxidase, superoxide dismutase and catalase were confirmed on administration of aqueous and ethanol extract of Caralluma geniculata at 300mg/kg bwt.

The level of bood glucose and creatine kinase also decreased significantly and serum protein reversed to its normal state on administration of extract of Caralluma geniculata when compared to high fat diet induced obese rats. Among aqueous and
ethanol extract of *Caralluma geniculata* tested aqueous extract produced better results in most of the parameters studied. The antiobesity effect of *Caralluma geniculata* extract was compared with the standard Orlistat. Obese rats received high fat diet and treated with aqueous and ethanol extract of *Caralluma geniculata* at 100, 200, 300mg/kg bwt. reversed the altered biochemical composition significantly in tissues and serum compared to the obese control rats.

The results of the present study confirmed the medicinal values such as antioxidant, antidiabetic and antiobesity activity of *Caralluma geniculata*, so suitable protocol was derived for mass propagation and conservation of this wonderful medicinal plant.

Apical meristem and nodal explants of *Caralluma geniculata* were cultured on MS medium fortified with different concentrations of BAP, KN and PBA either alone or in combination ranging from 0.1-6mg/l for shoot induction. Multiple shoots were initiated within a week from apical meristem, and within 11 days of inoculation from nodal explant. The response of explants to different cytokinins was more are less similar when used individually but in combination with little amount of auxin produced better results. Of the different concentrations of cytokinins experimented combination of BAP 4mg/l with NAA 0.8mg/l and BAP 6mg/l with NAA 2mg/l was found to be better to produce multiple shoots from apical meristem. Similarly, BAP 6mg/l with NAA 0.8mg/l induced multiple shoots from nodal explants. Of the two explants (apical meristem, node) utilized apical meristem was found to be better in multiple shoot induction than nodal explant.

Among different auxins (IAA, IBA and NAA) used individualy NAA 2mg/l produced better rooting. But auxins in addition to cytokinin particularly BAP 2mg/l with NAA 6mg/l induced an average of 6 roots from apical meristem explants within a
few days, whereas IAA and IBA haven’t produced any roots when used alone or in combination with BAP.

NAA 4mg/l produced an average of 6.4 number of roots in the saplings raised from nodal explants, whereas nodal explants cultured on MS medium treated with BAP 2mg/l in association with NAA 6mg/l produced an average of 10.6 number of roots. Thus, the results of the present study suggest that high concentration of BAP 4-6mg/l with low concentration of NAA 0.8-2mg/l produced maximum number of shoots. Similarly, low concentration of BAP 2mg/l with high concentration of NAA 6mg/l induced more number of roots within a short duration. Hence, the derived protocol showed that plant growth regulators such as BAP and NAA alone are enough for mass multiplication of *Caralluma geniculata*.

The well rooted plantlets were carefully taken out from the culture vials and were washed thoroughly with distilled water to remove the culture medium. Then they were transplanted to the paper cup containing garden soil or a mixture of farmyard manure, red soil and sand in the ratio of 1:1. The growths of the plantlets were monitored regularly.