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RESEARCH ARTICLE

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Fourier transform infrared spectroscopy analysis of various solvent extracts of *Caralluma fimbriyata*

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Abstract
Caralluma fimbriyata an edible succulent cactus is a perennial herb growing in dry parts of Tamil Nadu, India. It belongs to the family Apocynaceae. Caralluma have found medicinal uses in the treatment of Rheumatism, Diabetes, Leprosy, Antiseptics and Disinfectants. The main objective of the study is to observe the salient features exhibited by the Fourier Transform Infrared Spectroscopy the vibrational assignments, intensities and wave number of dominant peak were obtained from absorption spectra. Various functional groups like halogen, alkanes, carboxylic acid, aldehydes etc were identified by the various solvent extractions of Caralluma fimbriyata. This article attempts to reveal the use of Fourier Transform Infrared Spectroscopy and at the same time creating interest among the prospective researcher in herbal analysis and this study creates a platform to screen many bio active components to treat various diseases .

Keywords: *Caralluma fimbriyata*, crude, column, polar and nonpolar extracts, IR Spectra analysis.

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INTRODUCTION

Medicinal plants are good sources of antioxidants, and used as adjunctive therapy in the treatment of diabetes, diarrohoea, hyperlipidemia[1]. The main constituents of medicinal plants, such as saponins, flavanoids, and polyphenols are known to be major bioactive compounds in Ayurvedic medicine[2]. Most antioxidants isolated from medicinal plants are polyphenols, which show biological activities include anti bacterial, anti inflammatory, anti obesity, antiviral, anti carcinogenic and immune stimulating effect. The use of herbal remedies for arthritis treatment has been gaining momentum in recent years[3].

Caralluma, a cactus plant belongs to family Asclepiadaceae is a succulent, perennial herb, grow to a height of 1 to 10 ft and grow in different regions of India. The members of genus Caralluma are erect and fleshy. They have quadrangular stem, devoid of leaves and small flowers in several varieties of dark colour. The species of Caralluma found in India are edible and form a part of traditional medical system of country[4].

Caralluma species present in India are edible and also take part in traditional medicine of our country [5]. People in semi arid areas of Pakistan used the species of Caralluma for centuries as emergency foods [6]. Caralluma extracts have also been found to be appetite suppressant property which is well known to Indian tribal and hunters. In another report, it was observed that *C. fimbriata* can be used in weight reduction Caralluma species is known for its antihyperglycemic activity and *C. edulisis* for antidiabetic properties[7].The extract of *C. attenuate* and *C. edulis* had hypoglycemic properties and provide synergistic effect in combination with the phlorizin extract which beneficially modified glucose transport, blood and urine glucose levels, blood insulin levels and helps in weight loss [8]. The indiscriminate and destructive harvesting of these plants continues unable despite increased governmental regulation, resulting in many species becoming endangered. *C. nilagiriana* is a succulent medicinal plant depleted due to over exploitation, lack of organized cultivation and completely eaten by sheep and goats, the wild population has become restricted to Nilgiris, Tamilnadu. Regrettably, this species has now been added to the list of Indian endemic plants [9].

Many recent studies revealed that Caralluma is an important medicinal plant. Keeping the values of Caralluma in mind the present investigation was carried out to screen the biomolecules present in aqueous, petroleum ether, chloroform, ethanol and acetone extracts of the aerial part of *Caralluma fimbriyata* collected from Maruthvamalai, Kanyakumari District, Tamilnadu, India and to determine their functional group using (FT-IR) spectral analysis.

MATERIALS AND METHODS

Collection of Plant Materials:

Fresh young plants of *Caralluma fimbriyata* were collected from Viralimalai, Pudukkottai district, Tamilnadu, India. The plants were identified in Rapinat herbarium, St josephs College, Tiruchirappalli. The stem was separated from the collected plant. Then it was air dried in shade for 15 days and then pulverized to fine powder for further analysis.

Chromatography:

Column chromatography is used to purify liquids by separating an organic solvent from a mixture of solvent.

Preparation of Leaf Extract:

The stem extract (5mg) was prepared by grinding the mixture in mortar pistol containing 22 ml of acetone, 3 ml petroleum ether and calcium carbonate. The extract was filtered and mixed with 20 ml petroleum ether and 20 ml of 10% aqueous sodium chloride solution. The separating funnel was shaken carefully and the lower layer was allowed to drain in to the beaker.

Preparation of Column:

A plug of cotton is placed to the bottom of the column so that silica and soil won't fall out. Slurry of silica was prepared and poured into the column carefully. After settling the silica the sand is added.

Loading of Sample:

The sample was added using a pasture's pipette carefully above the sand. The eluent is added to the top of the sand. The mobile phase slowly flows down through the silica gel column by gravity leaving behind zone of color and a component was eluted from the column. The eluted compounds are allowed to air dry for 5-10 days. The dried eluted substances are subjected for FTIR analysis. This analysis is helps to know the functional group present in the plant. In the present study of *Caralluma fimbriyata* plants of different parts were analyzed by column chromatography and then the eluted compounds are further analyzed by FTIR.

The eluted compounds were compared for their changes in functional group and its activity.

Fourier Transform Infrared Spectroscopic Analysis (FT-IR):

The whole plant *Caralluma fimbriyata* was oven dried at 60^0C and ground into fine powder using a mortar and pestle. Two milligrams of the sample was mixed with 100mg KBr (FT-IR grade) and then compressed to prepare a salt disc (3mm diameter). The disc was immediately kept in the sample holder and FT-IR spectra were recorded in the absorption range between 400 and 400cm^{-1}. All investigations were carried out with a Shimadzu FT-IR spectrometer.

RESULT

The present study showed that different compounds were separated from *Caralluma fimbriyata* by using column chromatography. The eluted sample is allowed to dry in air. These eluted compounds were subjected to FTIR analysis. The FTIR spectrum was used to identify the functional group of the active components based on the peak value in the region of infrared radiation. The results of FTIR peak values and functional groups were represented in table 1, 2, 3 and 4. The presence of various functional groups of different compounds was found. FTIR spectroscopy is proved to be a reliable and sensitive method for detection of biomolecular composition.

S.no	Peak value	Stretching	Interpretation
1	596.00	C-Br stretching	Halogen
2	675.09	-C-Cl Stretching	Halogen
3	1116.78	-C-F	Halogen
4	1413.82	-C-C	Aromatics
5	1521.84	N=O	Nitro compounds
6	1560.41	N=0	Nitro compounds
7	1743.00	C=O	Acid Anhydrides
8	1797.66	C=O	Acid Anhydrides
9	2289.50	N-H	Aminoacids
10	2927.94	C-H	Alkanes
11	3431.36	O-H	Alcohol
12	3726.47	N-H	Amides

TABLE 1: Infra red spectrum analysis by *Caralluma fimbriyata* aqueous stem extract

S.no	Peak value	Stretching	Interpretation
1	501.49	C-Br stretching	Halogen
2	675.09	C-Cl stretching	Halogen
3	779.24	C-H stretching	Aromatic compounds
4	921.97	C-O stretching	Ethers
5	1078.21	C-O stretching	Ethers
6	1382.96	C-H stretching	Alkanes
7	1404.18	C-H stretching	Alkanes
8	1523.76	N-H stretching	Amides
9	1598.99	C-H stretching	Aldehydes
10	1658.78	C=O stretching	Ketones
11	1728.22	C=O stretching	Acid Anhydrides
12	1782.22	C=O stretching	Acid Anhydrides
13	1809.23	C=O stretching	Acid Anhydrides
14	1853.59	C=O stretching	Acid Anhydrides
15	1901.81	C=C stretching	Alkynes
16	2270.22	N-H stretching	Aminoacids
17	2382.09	N-H stretching	Aminoacids
18	2926.01	C-H stretching	Alkanes
19	3400.50	N-H stretching	Amides
20	3631.96	O-H stretching	Alcohols
21	3697.54	O-H stretching	Alcohols
22	3782.41	O-H stretching	Alcohols

Table 2. Infra red spectrum analysis by *Caralluma fimbriyata* coloumn compound

S.no	Peak value	Stretching	Interpretation
1	651.94	C-Cl stretching	Halogen
2	673.16	C-Cl stretching	Halogen
3	779.24	C-H stretching	Aromatic compounds
4	840.96	C-Cl stretching	Halogen
5	921.97	C-O stretching	Ethers
6	1078.21	C-F stretching	Halogen
7	1151.50	C-F stretching	Halogen
8	1384.89	C-O stretching	Alcohol
9	1462.04	C-H stretching	Alkenes
10	1494.83	C-F stretching	Halogen
11	1544.98	C-H stretching	Aldehydes
12	1602.85	C=C stretching	Alkenes
13	1658.78	C-H stretching	Aldehydes
14	1707.00	C=O stretching	Esters
15	1724.36	C=O stretching	Lactones
16	1739.79	C=O stretching	Lactones
17	1853.59	C=O stretching	Acid Halides
18	1901.81	C=O stretching	Acid Halides
19	2378.23	N-H stretching	Carboxilic acids
20	2852.72	O-H stretching	Carboxilic acids
21	2922.16	O-H stretching	Amides
22	3402.43	N-H stretching	Amides
23	3695.61	O-H stretching	Alcohols
24	3782.41	O-H stretching	Alcohols

TABLE 3: Infra red spectrum analysis by *Caralluma fimbriyata* methanol extract

S.no	Peak value	Stretching	Interpretation
1	569.00	C-Br Stretching	Halogen
2	651.94	C-Cl Stretching	Halogen
3	673.16	C-Cl Stretching	Halogen
4	777.31	C-Cl Stretching	Halogen
5	931.62	C-H Stretching	Aromatic compounds
6	1041.56	C-O Stretching	Ethers
7	1085.92	C-O Stretching	Ethers
8	1120.64	C-O Stretching	Ethers
9	1263.37	N=O Stretching	Nitrocompound
10	1321.24	N=O Stretching	Nitrocompound
11	1382.96	C-H Stretching	Alkanes
12	1406.11	C-H Stretching	Alkanes
13	1425.40	C-H Stretching	Alkanes
14	1463.97	C-H Stretching	Alkanes
15	1527.62	N=O Stretching	Nitrocompound
16	1589.34	N=O Stretching	Nitrocompound
17	1656.85	N=O Stretching	Nitrocompound
18	1705.07	C=O Stretching	Aldehydes
19	1722.43	C=O Stretching	Ketones
20	1739.79	C=O Stretching	Acid anhydrides
21	1782.23	C=O Stretching	Acid anhydrides
22	1809.23	C=O Stretching	Acid anhydrides
23	1853.59	C=0 Stretching	Ketones
24	1899.88	C=O Stretching	Carboxilic acids
25	2376.30	N-H Stretching	Aminoacids
26	2852.72	C-H Stretching	Alkanes
27	2922.16	C-H Stretching	Alkanes
28	3402.43	N-H Stretching	Amines
29	3697.54	O-H Stretching	Alcohols
30	3784.34	0-H Stretching	Alcohols

Table 4: Infra red spectrum analysis by *Caralluma fimbriyata* petroleum ether extract.

The absorption spectra of aqueous sample stem are show in fig.2. The dominant band in case of stem was observed at 596.00, 675.09, and 1116.78 cm^{-1} represents halogens compound. The band at 1521.84, and 1560.41 cm^{-1} was due to nitro compound. The peak at 1743.00, and 1797.66 cm^{-1} representing Acid anhydrides. The peak at 3431.36 indicated alcohol group. The band at 2927.94 cm^{-1} was due to the presence of alkanes. The band at 1413.82 shows Aromatic compounds. The peak at 2289.59 cm^{-1} shows Amino acids. The band at 3726.47 cm^{-1} show represent the presence of Amides.

The absorption spectra of the column compound extracts sample are shown in fig.3. The strong band was observed at 501.49, 675.09 cm^{-1} was attributed to halogens group. The band at 1382.96, 1404.18, and 2926.01 cm^{-1} was due to C-H stretching of alkanes. The band at 1728.22, 1782.22, 1809.23, and 1853.59 cm^{-1} revealed the presence of C=O stretching of Acid anhydrides . The band at 1901.81 cm^{-1} was attributed to C=C stretching of alkynes. The band at 921.97 and 107821 cm^{-1} was due to Ethers. Amides presence was determined by the presence of band at 1523.76, and 3400.50 cm^{-1}. The band at 3631.96, 3697.54, and 3782.41 cm^{-1} represent alcohols. The band at 779.24 cm^{-1} shows Aromatic compounds. The peak at 2270.22, 2382.09 cm^{-1} shows Amino acids.

The absorption spectra of the methanol extracts of stem sample are shown in fig.3. The band at 651.94, 673.16, 840.96, 1078.21, 1151.50, and 1494.83 cm^{-1} attributed to halogens group. The band at 1384.89, 3695.61, and 3782.41 cm^{-1} represent alcohol. The absorption band at 1462.04, 1602.85 cm^{-1} represent alkenes. The peak at 779.24 cm^{-1} indicates C-H stretching of aromatic compounds. C=O stretching was found to be Acid halides present due to the appearance of absorption peak at 1853.59, and 1901.81 cm -1 . The band at 921.97 cm^{-1} was due to ethers. The band at 2922.16 and 3402.43 cm^{-1} represent amides. The peak at 2378.23 and 2852.72 cm^{-1} indicates carboxylic acids. The band at 1707.00 cm^{-1} represents esters. The band at 1724.36 and 1739.79 cm^{-1} revealed the presence of lactones.

The absorption spectra of petroleum ether sample stem are show in fig.4. The dominant band in case of stem was observed at 569.00, 651.94, 673.16 and 717.31cm-1represents halogens compound. The band at 1263.37, 1321.24, 1527.62, 1589.34 and 1656.85 cm-1was due to nitro compound. The peak at 1739.79, 1782.23 and 1809.23 cm-1representing Acid anhydrides. The peak at 3697.54 and 3784.34cm -1 indicated alcohol group. The band at 1382.96, 1406.11, 1425.40, 1463.97, 2852.72 and 2922.16 cm-1was due to the presence of alkanes. The band at 931.62 cm-1shows Aromatic compounds. The band at 1041.56, 1085.92 and 1120.64 cm^{-1} was due to ethers. The peak at 2376.30 cm^{-1} shows Amino acids. The band at 3402.43 cm^{-1} show represents the presence of Amines. The peak at 1899.88 cm^{-1} indicates carboxylic acids. The band at 1705.07 cm^{-1} represents aldehydes. The peak at 1853.59 cm^{-1} shows ketones. Significant changes have been recorded in the functional groups of different solvent extracts in *Caralluma fimbriyata* subjecting the sample for FTIR.

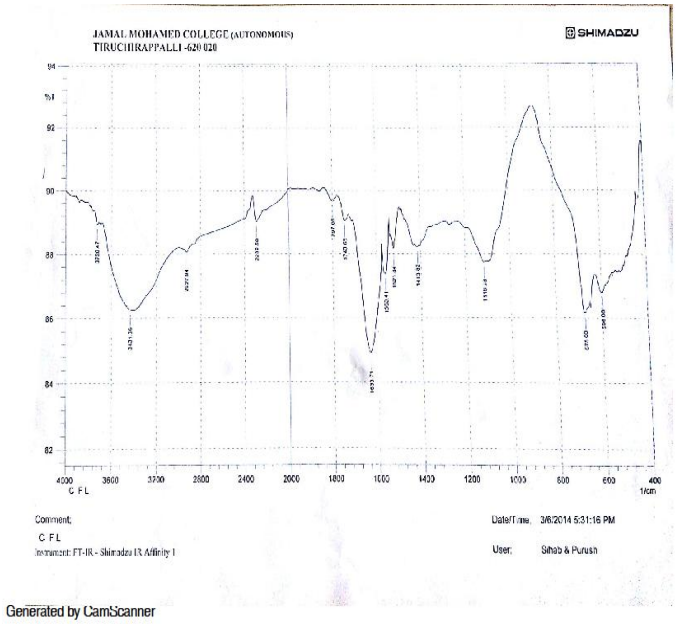

Figure 1: Infra red spectrum analysis by *Caralluma fimbriyata* aqueous stem

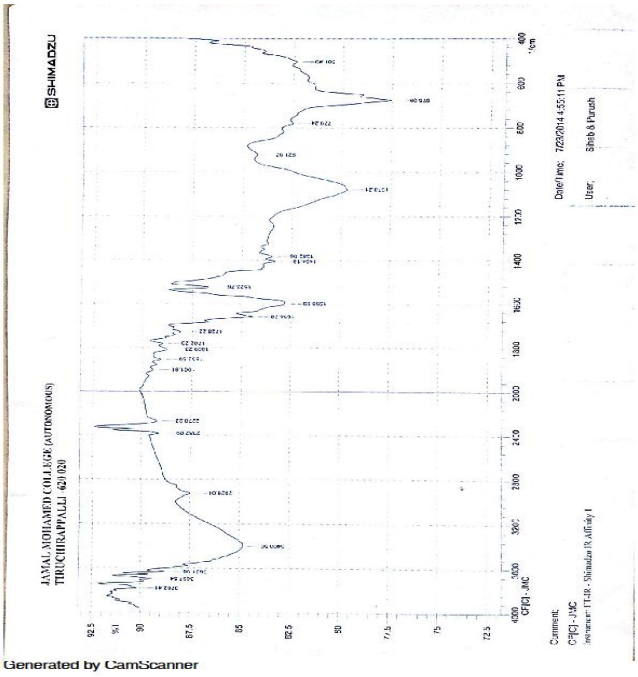

Figure 2: Infra red spectrum analysis by *Caralluma fimbriyata* column compound

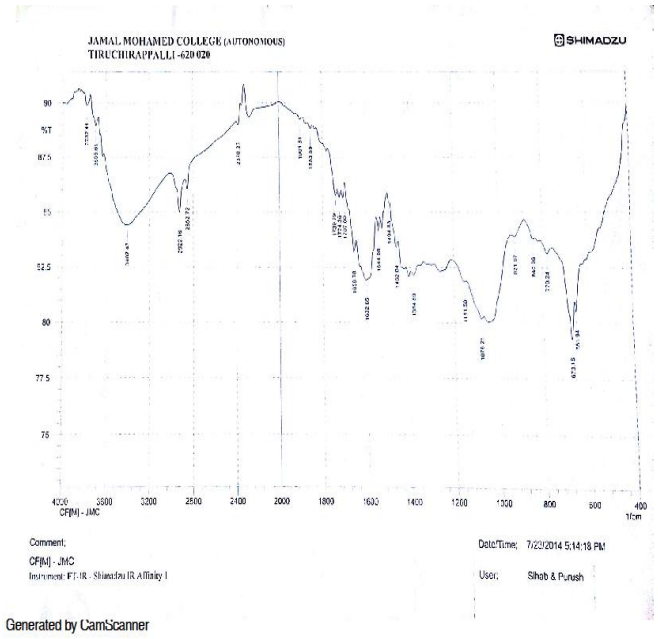

Figure 3: Infra red spectrum analysis by *Caralluma fimbriyata* methanol extract

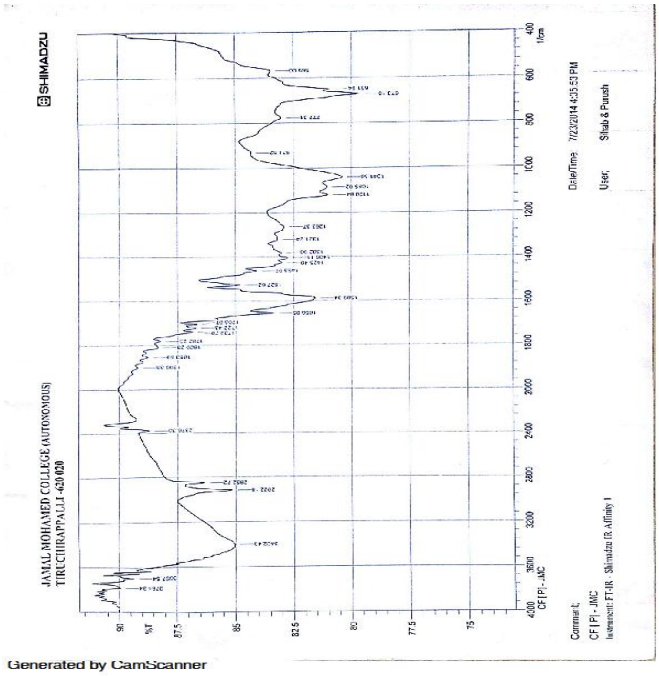

Figure 4: Infra red spectrum analysis by *Caralluma fimbriyata* petroleum ether extract

DISCUSSION

In the earlier study Asha et al reported that *Caralluma geniculata* is a medicinal plant, has been used as a folkloric medicine to treat amentia, anorexia, fever, swelling and rheumatism. In earlier studies reported that *Caralluma fimbriyata* has antileishmanial activity of acetone and methanol extract.

C. umbellata also exhibited significant antinociceptive activity, this is due to the presence of novel pregnane glycoside named Carumbelloside II and V, and anti-inflammatory activity due to the presence of pregnane glycoside Carumbelloside II and III [10, 11] . Similarly leaf extract of *Caralluma fimbriata* exhibited analgesic activity [12]. Saivasanthi and her coworkers evaluated and identified the analgesic, anti-inflammatory and anxiolytic activity of *C. fimbriata* [13]. Leaf extract of *C. fimbriata* shows significant anti-nociceptive activity [14]. Experimented the appetite suppressant and antiobesogenic effects of *C. fimbriata* extract on a sample of rats fed with cafeteria diet and observed the potential of CFE to curb obesity and the pathologies linked to obesity. The gastroprotective effect of *C. adscendens var. fimbriata* due to its antioxidant property was proved [15].

The present work identify the functional groups these groups do the wonderful role against the pathogens.

CONCLUSION

An attempt has been made in this work to study the functional derivatives of the sample. By observing the position and relative intensities of the band in FTIR. The spectral analysis indicated that the specific functional groups. FTIR spectroscopy technique showed that the presence of functional groups which can be isolated and further screened for different kind of biological activities depending their therapeutic uses. Further research will be needed to find out the structural analysis of compound by use of different analytical method such as NMR and Mass spectrophotometer.

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REFERENCES

1.Burits M, Bucar F. Antioxidant activity of Nigella sativa essential oil. Phytotherapy Research. 2000; 14:323-328. http://dx.doi.org/10.1002/1099-1573(200008)14:5<323::AID-PTR621>3.0.CO;2-Q

2.Andrzej L, Dawidowicz, Dorota Wianowska and Barbara. The antioxidant properties of alcoholic extracts from Sambucus nigra L. (antioxidant properties of extracts). LWT- Food Science and Technology. 2006; 39: 308-315.

3.Matsui T, Tanaka T, Amura S, Toshima A, Miyata Y, Tanaka K.Alpha-glucosidase inhibitory profile of catechins and theaflavins. Journal of Agricultural and Food Chemistry. 2007; 55: 99-105. http://dx.doi.org/10.1021/jf0627672

4.AL-Yaha MA, Abdel-Sattar E. Pregnane Glycoside from Caralluma russeliana. J.Nat.Prod., Chemical constitue . 2000; 63 (45):1453.

5.Lawrence RM, Choudhary S.*Caralluma fimbriata* in the treatment of obesity .12th annual congress on anti aging medicine. Winter session December 2- 5. Las vegasNv USA.2004.

6.Venkatesh S, Reddy GD, Reddy BM, Ramesh M, Rao AVNA. Antihyperglycemic activity ofCaralluma attenuate. Fitoterapia. 2003; 74: 274-279. http://dx.doi.org/10.1016/S0367-326X(03)00021-2

7. Wadood A,Wadood N,Shah SA .Effect of Acacia arabica and Caralluma edulis on blood glucose levels of normal and alloxan diabetic rabbits. J.Pak. Med. Assoc. 1989;9: 208-212.
8.Khan AW, Khatoon S Ethnobotanical studies on some useful herbs of Haramosh and Bugrote valleys in Gilgit, northern areas of Pakistan. Pak. J. Bot.2008; 40:43-58.
9.Ray S, Sharma A, Nagaiah K. International Journal of Comprehensive Pharmacy. 2012; 03(01): 1-2.
10.Ray S, Nagaiah K. Journal of Pharmaceutical and Biomedical Sciences. 2011; 12 (13):1-3
11.Ray S, Nagaiah K, Khan FN. NSHM Journal of Pharmacy and Healthcare Management 2011; 02: 83-88.
12.Ray S, Rahaman N, Basu A, Ray SG. Journal of Pharmaceutical and Biomedical Science. 2012; 18(15): 1-3.
13.Saivasanthi V, Gowthamigoud, Swathi K, Aakruthi S, Rani A, Gupta AS Rao. International Journal of Pharmacy. 2011; 1(1): 40-45.
14.Kamalakkannan S, Rajendran V, Venkatesh RV, Clayton P, Akbarsha MA. Antiobesogenic and antiatherosclerotic properties of *Caralluma fimbriata* extract. Journal of Nutrition and Metabolism.2010; 6 :1155.
15.Malkapur MD, Gunagambire MV, Mahorkar NKR, Konduri P. Journal of Pharmacy Research. 2012;5(3): 1574-1577.