British Journal of Research

www.britishjr.org

Original Article

Essential Oil Composition (Terpenes) of *Salacia senegalensis* Lam (DC) Leaf

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A B S T R A C T

Salacia senegalensis is an acclaimed medicinal plant use locally by the people of the South-East zone Nigeria in the treatment of malaria, skin problem like eczema and lotion for sick children. However, no scientific data on essential oil (terpenes) composition of its leaves have been reported. Hence, the essential oil compositions of its leaves were analyzed using Gas Chromatography (GC). A total of 38 compounds (essential oil) was identified and the most abundant as shown in the results are Alpha Terpinene (13.8 %), Germacrene D (12.4 %), Alpha phenandrene (11.6 %), Alpha Pinene (11.5 %), Alpha Caryophyllene (11.2 %), Linalool (9.2 %), Caryophyllene Oxide (9.1 %), Cymene (8.3 %), Carvacrol (5.6 %), 1, 8-Cineole (4.9 %) and Beta Pinene (1.8 %).

Keywords: Essential oil, Medicinal, *Salacia senegalensis, GC.*

INTRODUCTION

Salacia senegalensis Lam (DC) is a shrub erect or climbing with white or pale greenish cream petals and orange or yellow flowers. It belongs to the family Celestraceae[1]. Traditionally, the leaf extracts are used as antimalarials, lotion for sick children and in the treatment of skin problem like eczema by the people of the South-East zone of Nigeria[1]. Since ancient times, essential oils have been recognized for their medicinal value and they are very interesting and powerful natural plant products. They continue to be of paramount importance until the present day. Essential oils have been used as perfumes, flavors for foods and beverages, or to heal both body and mind for thousands of years[2-5]. In the era of the Renaissance, Europeans have taken over the task and with the development of science the composition and the nature of essential oils have been well established and studied[6-9].

Essential oils (also called volatile or ethereal oils, because they evaporate when exposed to heat in contrast to fixed oils) are odorous and volatile compounds found only in 10% of the plant kingdom and are stored in plants in special brittle secretory structures, such as glands, secretory hairs, secretory ducts, secretory cavities or resin ducts[10-17]. Essential oils constitute a major group of agro-based industrial products and they find applications in various types of industries, such as food products, drinks, perfumes, pharmaceuticals and cosmetics[6,18-24]. Germacrene D, α-Caryophyllene and α-Pinene are cytotoxic to cancer cells[25]. Anti-carcinogenic property of Linalool has been reported[26]. Also, anti-bacterial properties of Carvacrol, α-Terpinene and Cymene have been reported[27]. However, no scientific data on essential oil (terpenes) composition of *the Salacia senegalensis leaf* has been reported; therefore, the aim of this work is to analyze the essential oil compositions its leaf.

MATERIALS AND METHODS

Plant material collection and authentication

The acclaimed medicinal plant *Salacia senegalensis* (**figure 1**) was obtained from the forest of Orji Owerri North L.G.A, Imo State, Nigeria, identified and authenticated by taxonomists Prof Okeke, SE and Mbagwu, FN (PhD) of the Department of Plant Science and Biotechnology Imo State University, Owerri, Nigeria.

Extraction and isolation of essential oil

The extraction was carried out according to the method of[28].

Principle

The leaf was extracted with chloroform, before subjecting the extract to chromatographic analysis.

Materials

These include,

1. The leaf sample (whole leaf powder)
2. Re-distilled chloroform
3. Weighing balance, water bath, rotary evaporator, timer, GC machine, 250ml conical flask, 100ml borosilicate beakers, Whatman N0.1 filter paper and funnel.

Procedure

Three grams of the pulverized sample were extracted three times with 30ml of re-distilled chloroform for 15 minutes at a regulated temperature of 40 ^{0}C in a 250 ml conical flask, placed in a water bath. The resultant mixture was filtered with Whatman N0.1 Filter paper and the filtrate concentrated to 1ml in the vial for gas chromatography analysis and 1µL was injected into the injection port of the GC.

Chromatographic conditions

The gas chromatograph was an HP 6890 (Hewlett Packard, Wilmington, DE, USA), GC apparatus, fitted with flame ionization detector (FID), powered with HP Chemstation Rev. A09.01 [1206] software, to identify compounds. The column was a capillary HP 5MS column (30 m x 0.25 mm x 0.25 µm film thickness). The inlet and detection, temperature were 150 and 300 ^{0}C. Split injection was adopted with a split ration of 20:1. Hydrogen was used as the carrier gas, at a flow rate of 1.0ml/min. The hydrogen and compressed air pressure were 22psi and 28psi. The oven was programmed as follows: initial temperature of 40 ^{0}C. Ramped at 5 ^{0}C/min to 200 ^{0}C, and ran at 200 ^{0}C for 2 minutes.

RESULTS AND DISCUSSION

The leaves of this plant *Salacia senegalensis* are rich in essential oil as shown in **Table 1.** The Table 1.0 showed the amount in percentage of these oils. A total of 38 compounds was identified and quantified.

The most abundant are α-Terpinene (13.8 %), Germacrene D (12.4%), α-Phenanthrene (11.6%), α-Pinene (11.5 %), α-Caryophyllene (11.2 %), Linalool (9.2 %), Caryophyllene Oxide (9.1 %), Cymene (8.3 %), Carvacrol (5.6 %), 1, 8-Cineole (4.9 %) and β-Pinene (1.8 %). Germacrene D, α-Caryophyllene and α-Pinene found in the leaf of this plant are cytotoxic to cancer cells[25]. Linalool found in this leaf is anti-carcinogenic[26]. Also, anti-bacterial properties of Carvacrol, Caryophyllene Oxide, and α-Terpinene and Cymene found in the leaf of this plant has been reported[27]. Essential oils have many uses, both in pharmacology and in food. Essential oils exhibit antimicrobial activities, antiviral activities with broad spectrum, and may be useful as natural remedies and it seems that essential oils can be used as a suitable therapy for many pathologies[2-5]. In the cosmetic and in the food industry, essential oils are useful and may play different roles. **(See Chromatogram a & b).**

CONCLUSION

The leaves of this plant *Salacia senegalensis* are rich in essential oil, especially Alpha Terpinene, Germacrene D, Alpha Pinene, Alpha Caryophyllene, Linalool, Cymene, and Carvacrol, which has medicinal properties as discussed, thereby suggesting/ supporting the medicinal property of the leaf of this plant as used by the people of the South-East zone of Nigeria.

Conflict of interest

None.

REFERENCES

1. Nigeria National Medicine Development Agency (NNMDA) (2011) Salacia senegalensis, *Medicinal plants of South-East Zone*. Vol.1 pp 67.
2. Baris, O.; Güllüce, M.; Sahin, F.; Ozer, H.; Kılıc, H.; Ozkan, H.; Sökmen, M. and Ozbek, T. (2006). Biological activities of the essential oil and methanol extract of Achillea biebersteinii Afan Afan (Asteraceae). *Turkish J. Biol*., Vol.30, pp.65-73.
3. Margaris, N.; Koedam A. and Vokou, D. (1982). Aromatic Plants: basic and applied aspects. The Hague, London, Boston, Martinus Nijhoff Publishers.
4. Tisserand, R. B. (1997). In The Art of Aromatherapy; Healing Arts Press: Rochester, VT.
5. Wei, A. and Shibamoto, T. (2010). Antioxidant/Lipoxygenase Inhibitory Activities and Chemical Compositions of Selected Essential Oil. *J. Agric. Food Chem*. Vol.58, pp. 7218-7225.
6. Burt, S. (2004). Essential oils: their antibacterial properties and potential applications in foods. *International Journal of Food Microbiology*, Vol.94, pp. 223-253.
7. Peeyush, K.; Sapna, M.; Anushree, M.and Santosh, S. (2011). Insecticidal properties of Mentha species. *Industrial Crops and Products*, Vol.34, pp. 802-817.
8. Steven, B.K. (2010). Traditional Medicine: A global perspective. Edited by Steven B. K.; Pharmaceutical Press.
9. Suaib, L.; Dwivedi, G.R.; Darokar, M.P.; Kaira, A. and Khanuja, S.P.S. (2007). Potential of rosemary oil to be used in drug-resistant infection. *Alternative therapies*, Vol.13, pp. 54-59.
10. Ahmadi, L.; Mirza, M. and Shahmir, F. (2002). The volatile constituents of Artemisia marschaliana Sprengel and its secretory elements. *Flavour Fragr. J*., Vol.17, pp. 141-143.
11. Bezić, N.; Šamanić, I.; Dunkić, V.; Besendorfer, V. and Puizina, J. (2009). Essential Oil Composition and Internal Transcribed Spacer (ITS) Sequence Variability of Four South-Croatian

Satureja Species (Lamiaceae). *Molecules*, Vol.14, pp. 925-938.
12. Ciccarelli, D.; Garbari, F. and Pagni, A.M. (2008). The flower of Myrtus communis (Myrtaceae): Secretory structures, unicellular papillae, and their ecological role. *Flora*, Vol.203, pp. 85-93.
13. Gershenzon, J. (1994). Metabolic costs of terpenoid accumulation in higher plants. *Journal of Chemical Ecology*, Vol. 20, pp. 1281-1328.
14. Liolios, C.C.; Graikou, K.; Skaltsa, E. and Chinou, I. (2010). Dittany of Crete: A botanical and ethnopharmacological. *Journal of Ethnopharmacology*, Vol. 131, pp. 229-241.
15. Morone-Fortunato, I.; Montemurro, C.; Ruta, C.; Perrini, R.; Sabetta, W.; Blanco, A.; Lorusso, E. and Avato, P. (2010). Essential oils, genetic relationships and *in vitro* establishment of Helichrysumitalicum (Roth) G. Don ssp. italicum from wild Mediterranean germplasm. *Industrial Crops and Products*, Vol. 32, pp. 639-649.
16. Sangwan, N.S.; Farooqi, A.H.A.; Shabih, F.; and Sangwan, R.S. (2001). Regulation of essential oil production in plants. *Plant Growth Regulation*, Vol.34, pp.3-21.
17. Wagner, G.J. (1996). Secreting glandular trichomes: More than just hairs. *Plant Physiol*. Vol.96, pp. 675-679.
18. Anwar, F.; Ali, M.; Hussain, A.I.; and Shahid, M. (2009a). Antioxidant and antimicrobial activities of essential oils and extracts of fennel (Foeniculum vulgare Mill.) seeds from Pakistan. *Flavour Fragr. J*., Vol.24, pp.170-176.
19. Anwar, F.; Hussain, A.I.; Sherazi, S.T.H. and Bhanger, M.I. (2009b). Changes in composition and antioxidant and antimicrobial activities of essential oil of fennel (Foeniculum vulgare Mill.) fruit at different stages of maturity. *Journal of Herbs, Spices and Medicinals Plants*, Vol. 15, pp.1 16.
20. Celiktas, O. Y.; Kocabas, E. E. H.; Bedir, E.; Sukan, F. V.; Ozek, T. and Baser, K.H.C. (2007). Antimicrobial activities of methanol extracts and essential oils of Rosmarinus officinalis, depending on location and seasonal variations. *Food Chemistry*, Vol. 100, pp. 553-559.
21. Hammer, K.A.; Carson, C.F.; Dunstan, J.A.; Hale, J.; Lehmann, H.; Robinson, C.J.; Prescott, S.L. and Riley, T.V. (2008). Antimicrobial and anti-inflammatory activity of five Taxandriafragrans oils *in vitro*. *Microbiology and immunology*, Vol.52, pp. 522-530.
22. Hay, R.K.M. and Svoboda, K.P. (1993). Botany. In Volatile oil crops: their biology, biochemistry and production, Hay, R.K.M. and Waterman, P.G. (eds.), Longman Scientific & Technical, Harlow, pp. 5-22.
23. Hussain, A.I.; Anwar, F.; Sherazi, S.T.H.; and Przybylski, R. (2008). Chemical composition, antioxidant and antimicrobial activities of basil (Ocimumbasilicum) essential oils depends on seasonal variations. *Food Chem*., Vol. 108, pp. 986-995.
24. Teixeira da Silva, J.A. (2004). Mining the essential oils of the Anthemideae. *African Journal of Biotechnology*, Vol.3, pp. 706-720.
25. Palazzo, M.C, Wright, H.L, Agius, B.R, Wright B.S, Moriarity D.M, Haber, W.A and Setzer, W.N(2009) Chemical compositions and biological activities of leaf essential oils of six species of Annonaceae from Monterer de, Costa Rica. Records of natural products 3:3 pp153-160.
26. Burt, S.A, Vlielander, R, Haagsman, H.P, Veldhuize, E.J.A(2005) Increase in activity of essential oil components

Carvacrol and Thymol against Escherichia coli 0157:H7 by addition of food stabilizers. *Journal of food protection*, vol 8 no. 5 pp 919-926.

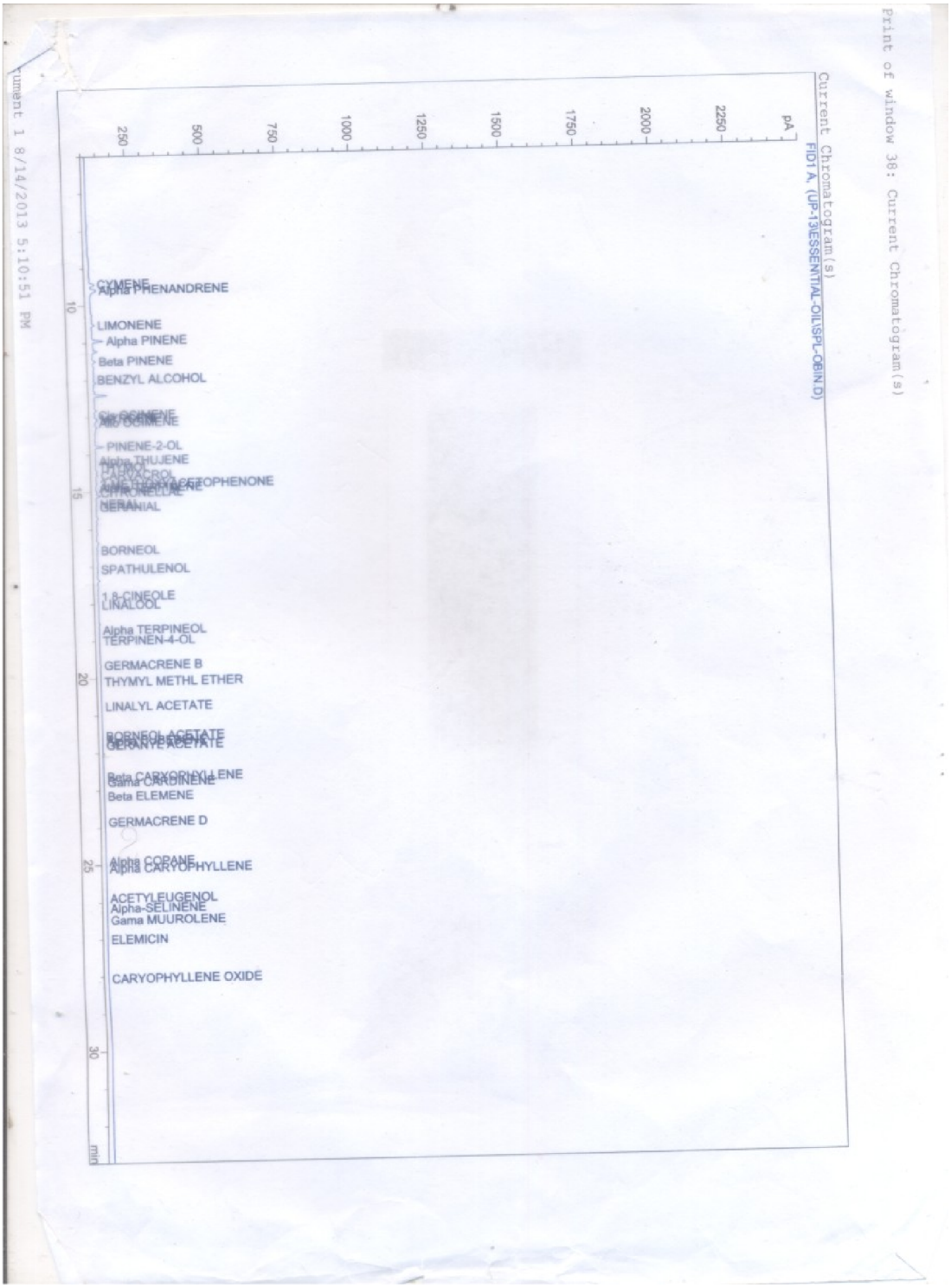
27. Srithar, G., Sudha, M and Nalini N (2013) Linalool exerts dose dependent chemopreventive effect against 1, 2-dimethylhydrazine induced rat colon carcinogensis. *Int'l Journal of pharmaceutical and biological archives*. 4(4): 758-770.
28. Ortan, A, Popescu, ML, Gaita, AL, Dinu-Pîrvu, C and Câmpeanu, GH (2009) Contributions to the pharmacognostical study on Anethum graveolens, Dill (Apiaceae). *Romanian Biotechnology Letters*. 14(2): 4342-4348.

 ISSN: 2394-3718

Table 1. The result of the essential oil composition (%) of *Salacia senegalensis* leaf extract

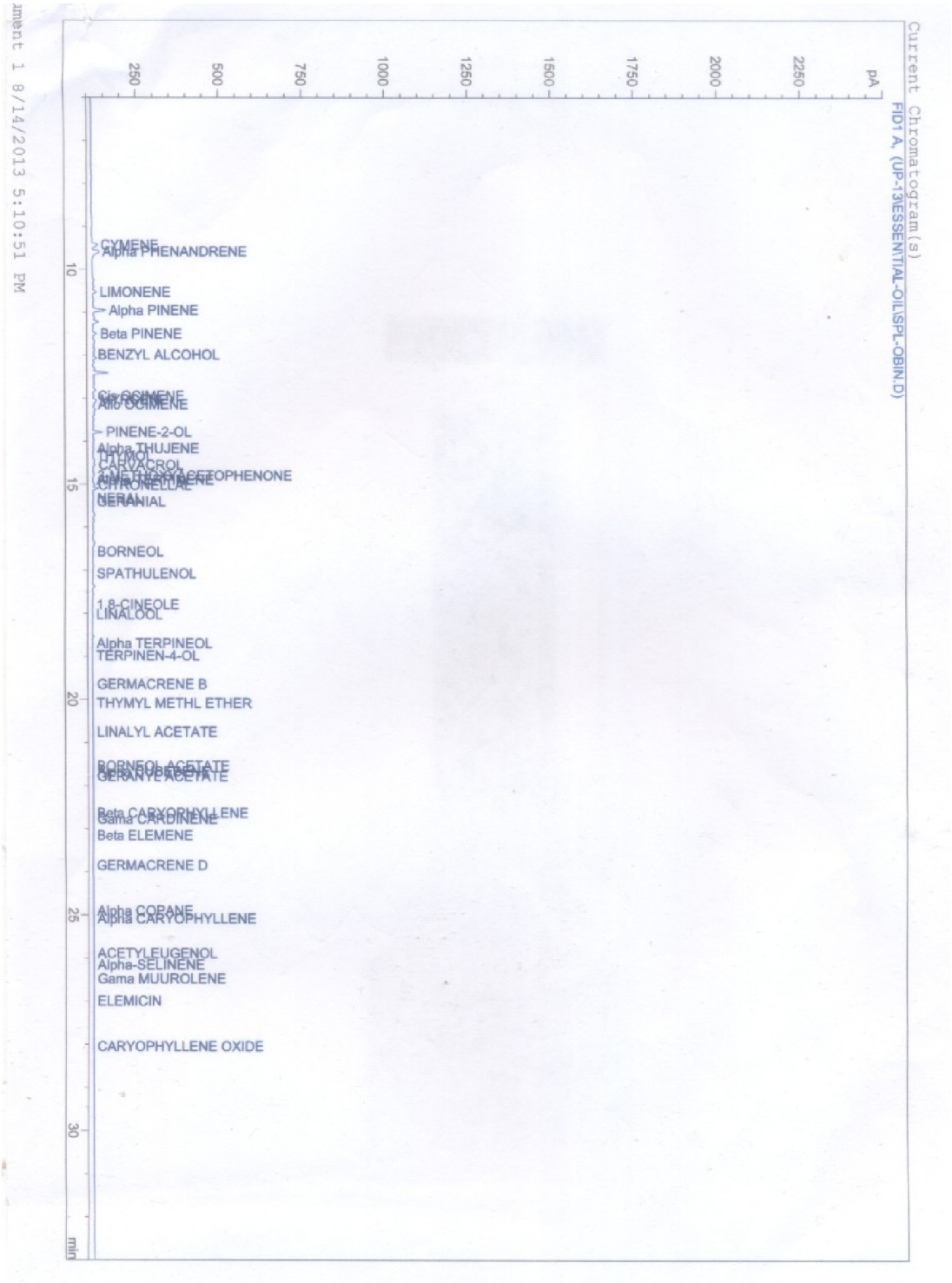
Essential oils	
Name	**Amount (%)**
Cymene	8.338385
Alpha phenandrene	11.616963
Limonene	0.004528
Alpha pinene	11.447172
Beta pinene	1.845321
Benzyl alcohol	0.008437
Cis Ocimene	0.000995
Myrcene	0.059536
Allo Ocimene	0.007836
Pinene -2-ol	0.005028
Alpha thujene	0.005128
Thymol	0.003073
Carvacrol	5.560731
3-Methoxyacetophenone	0.003078
Alpha terpinene	13.835094
Citronellal	0.003076
Neral	0.007387
Geranial	0.020167
Borneol	0.007101
1, 8-Cineole	4.933014
Linalool	9.197276
Alpha terpineol	0.003858
Terpinen-4-ol	0.043312
Germacrene B	0.093930
Methylethyl ether	0.004620
Linalyl acetate	0.006390
Borneol acetate	0.005299
Alpha cubebene	0.062270
Geranyl acetate	0.004940
Beta caryophyllene	0.060698
Gama cardinene	0.005391
Germacrene D	12.424949
Alpha caryophyllene	11.238487
Acetyleugenol	0.002964
Alpha-Selinene	0.002719
Gama Muurolene	0.003071
Elemicin	0.001749
Caryophyllene Oxide	9.121764

 ISSN: 2394-3718



Chromatogram a.

 ISSN: 2394-3718



Chromatogram b.

 ISSN: 2394-3718

Figure 1. *Salacia senegalensis*