Innovare Academic Sciences

International Journal of Pharmacy and Pharmaceutical Sciences

ISSN- 0975-1491 Vol 7, Issue 8, 2015

Short Communication

GC MS AND ELEMENTAL ANALYSIS OF CINNAMOMUM TAMALA

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Received: 13 May 2015 Revised and Accepted: 26 Jun 2015

ABSTRACT

Objective: To investigate the phytoconstituents and elements present in hexane (HEX), dichloromethane (DCM) and methanol (MET) extracts of *Cinnamomum tamala* (*CT*).

Methods: Gas chromatography–mass spectrometry (GC-MS) was carried out to determine the principal constituents present in HEX, DCM and MET extracts of *CT*. Elemental analysis of *CT* was carried out by X–Ray Fluorescence (XRF) spectrophotometer analysis.

Results: GC-MS analysis showed the presence of various compounds in HEX, DCM and MET extracts of *CT*. Eugenol was found to be the major compound in HEX and DCM extracts of *CT*. 2 compounds namely 2,6,10-trimethyl-12-oxatricyclo[7.3.0.0{1,6}]tridec-2-ene, Hexahydropyridine,4-[4,5-dimethoxyphenyl]-in HEX extract and 3 compounds in DCM extract namely 6á,19-CycloAndrost-4-ene-3,17-dione, 2,5-chloro-3β-hydroxy-6β-nitro-5α-androstan-17-one, Aceticacid,10,13-dimethyl-2-oxo-2,3,4,7,8,9,10,11,12,13,14,15,16,17-tetradecahydro-1H cyclopenta [a]phenanthren-17-ylester are newly reported. XRF analysis revealed the presence of various elements in *CT*. Out of these; calcium and potassium were found to be major elements, whereas titanium was found to be a minor element.

Conclusions: The results of the present study demonstrate the presence of 31 various important phytoconstituents in HEX, DCM and MET extracts of *CT* and presence of 13 elements in *CT*.

Keywords: Phytoconstituents, Extracts, Compounds, Elements.

Plant based products are experimentally shown to confer effective protection against oxidative stress and carcinogenesis. Oxidative stress is described as an imbalance between the production of free radicals and antioxidant defense mechanisms [1]. Free radicals such as Reactive Oxygen Species (ROS) and Reactive Nitrogen Species (RNS) damage membrane lipids, proteins and DNA causing arthritis, diabetes, atherosclerosis, degenerative brain disorders and cancer [2, 3]. Hence, identification and characterization of medicinal plants are gaining importance due to their non–toxic nature and lesser side effects [4].

Cinnamomum tamala (Buch–Ham) Nees and Eberm, commonly known as Indian cassia is a small ever green tree belonging to the Lauraceae family. The leaves of this plant are generally called as Indian bay leaf, Tejapat (or) Tamalpatra. Previously, *CT* leaf extracts have been shown to possess antioxidant [5], anti-diabetic [6, 7] immunosuppressive [8], gastro-protective [9], anti-diarrheal [10], anti-bacterial [11], anti-fungal [12], anti-inflammatory, anticancer and hepato-protective properties [13].

Prior studies have also determined the phytochemical constituents present in the essential oil of *CT* leaves [reviewed in Ref.13]. In this present study, by employing GC-MS we report the presence of 5 novel phytochemical constituents in HEX, and DCM extracts of *CT*. In addition, we have determined the percent of elements present in *CT* leaf powder by XRF analysis.

CT leaves were obtained from a local market at Pondicherry, India. Before use, the leaves were extensively washed with distilled water. They were shade dried at room temperature until it became crisp. 50 g of dried *CT* leaves were powdered coarsely and transferred into a soxhlet apparatus and extracted sequentially by HEX, DCM and MET respectively. The solutions obtained by the respective solvents were concentrated by using rotavapor.

GC-MS Analysis was performed using a JEOL GCMATE II GC-MS spectrometer. This instrument was placed at an initial temperature of 110 °C and maintained at this temperature for 2 min. At the end of this period, the oven temperature was increased to 280 °C. At the rate of 5 °C /min. maintained for 9 min. The injection port temperature was ensured at 250 °C and helium flow rate at 1 ml/min. The ionization voltage was 70 eV. The samples were injected in split mode at 10:1. Mass spectral scan range was at the rate of 45-450 (m/z). Using computer searches on a National Institute of Standards and Technology (NIST) Ver.2.1 MS data library and comparing the spectrum obtained through GC–MS compounds present in the plant extracts were identified.

CT leaf powder was ground with boric acid and analyzed on a Bruker S4–Pioneer XRF spectrophotometer. Rhodium was used as standard anode material. It is designed to give a permanent output of 4 kW. Scintillation counter serves as a detector and proportion of counters.

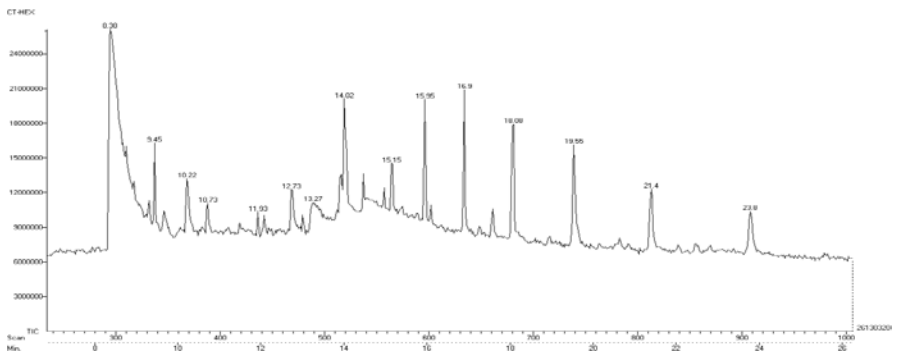

Fig. 1: GC-MS Chromatogram of HEX extract of *CT*

Mass spectra of the compounds observed in the extracts of *CT* were matched with the NIST library. GC-MS Chromatogram of HEX extract of *CT* (fig. 1) representing 8.38–Phenol,2-methoxy-3-[2-propenyl], 9.45–1H-Indene,1-ethylideneoctahydro-7a-methyl-, cis, 10.22–Spathulenol, 10.73–2,6,10-trimethyl-12-oxatricyclo [7.3.0.0 {1,6}] tridec-2-ene, 11.93–Hexahydropyridine,4-[4,5-dimethoxyphenyl], 12.73–Dodecanoic acid,10-methyl-,methyl ester, 13.27–n-hexadecanoic acid, 14.02–Phytol, 15.15–Octadecane, 15.98–Eicosane, 2-methyl, 16.9–Docosane, 18.08–Tricosane, 19.55–Tetracosane, 23.8–Nonacosane.

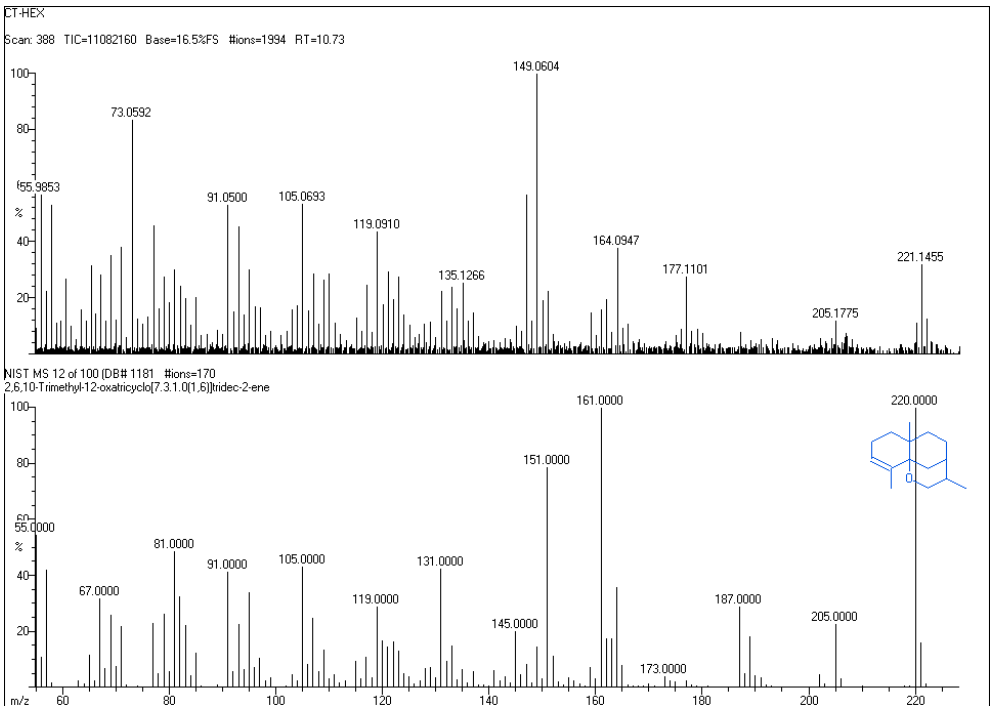

Fig. 2: Mass spectra of 2,6,10-trimethyl-12-oxatricyclo[7.3.0.0{1,6}]tridec-2-ene

Out of these 2, 6, 10-trimethyl-12-oxatricyclo [7.3.0.0{1, 6}] tridec-2-ene with RT-10.73(fig. 2) and hexahydropyridine, 4-[4,5-dimethoxyphenyl] with RT-11.93 (fig. 3) are the 2 newly reported compounds found in the HEX extract of *CT*.

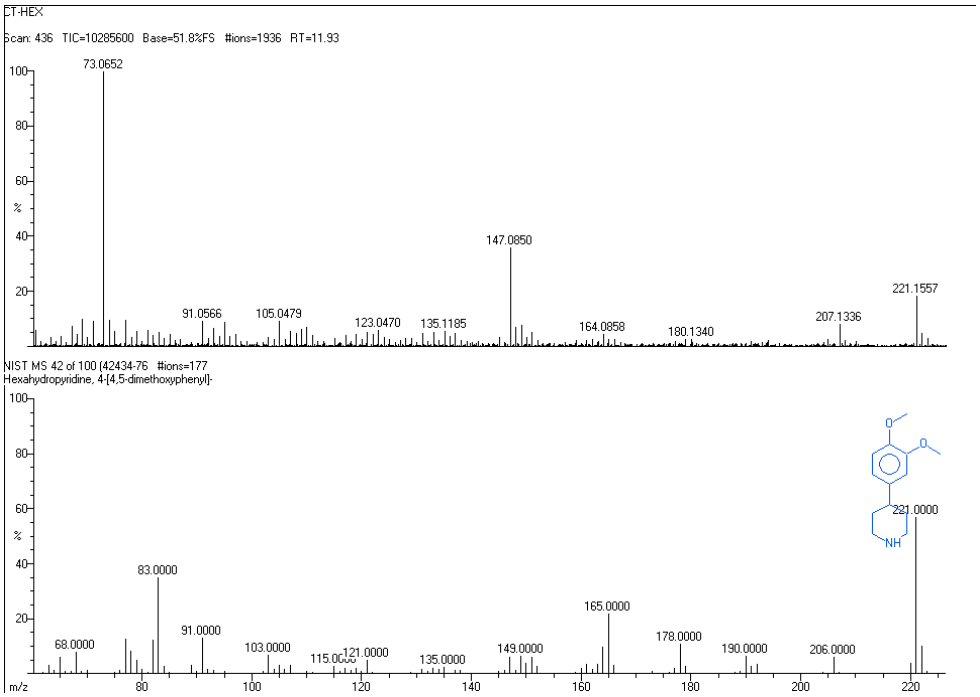

Fig. 3: Mass spectra of hexahydropyridine, 4-[4, 5-dimethoxyphenyl]

GC-MS Chromatogram of DCM extract of *CT* (fig. 4) representing 10.73–Phenol,2-methoxy-3-[2-propenyl], 12.98–Phenol,2-methoxy-4-(2-propenyl)-,acetate, 13.38–Tricyclo[5.2.2.0(1,6)]undecan-3-ol,2-methylene-6,8,8-trimethyl, 16.18–3-Eicosyne, 16.65–hexadeca-2,4,15-trienoicacid, ethylester, 17.17–Pentadecanoicacid,14-methyl-, methylester, 17.83–n-hexadecanoic acid, 18.87–10-octadecenoicacid, methylester, 19.75–6á,19-Cycloandrost-4-ene-3,17-dione, 26.58-5-chloro-3β-hydroxy-6β-nitro-5α-androstan-17-one.

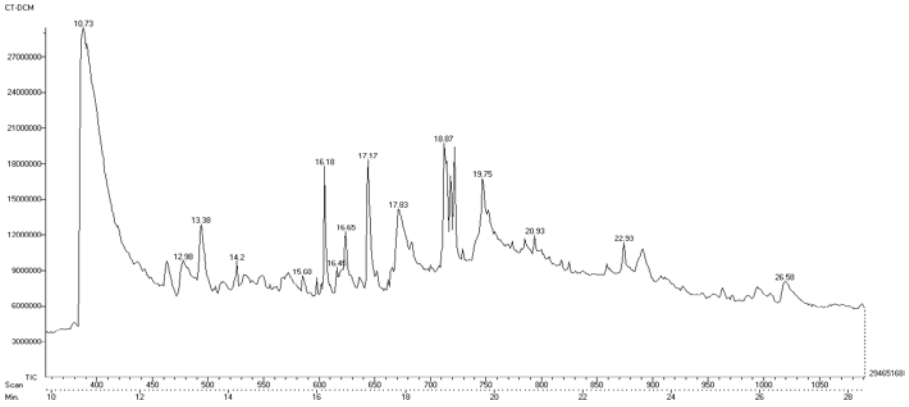

Fig. 4: GC-MS chromatogram of DCM extract of *CT*

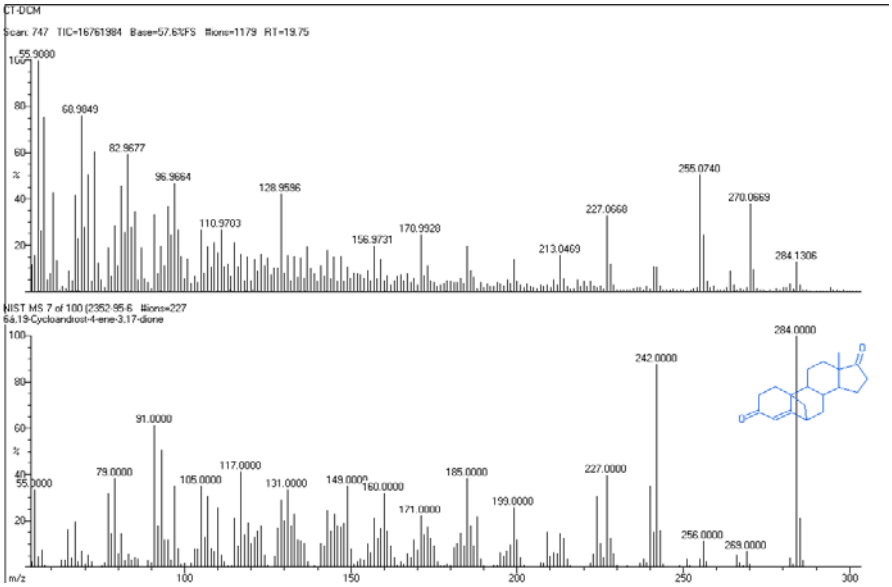

Fig. 5: Mass spectra of 6á,19-Cyclo Androst-4-ene-3,17-dione

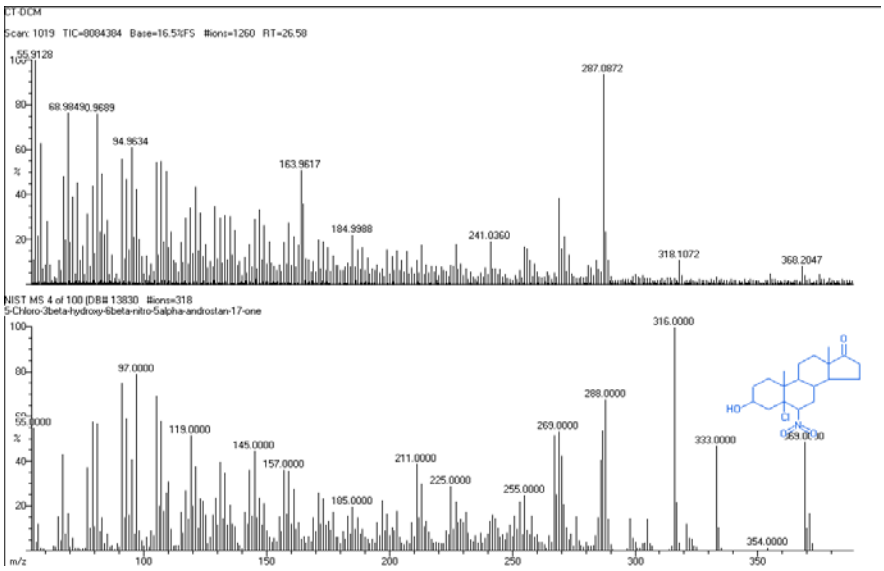

Fig. 6: Mass spectra of 5-chloro-3β-hydroxy-6β-nitro-5α-androstan-17-one

Out of above mentioned compounds 6á,19-Cyclo Androst-4-ene-3,17-dione with RT–19.75 (fig. 5), 5-chloro-3β-hydroxy-6β-nitro-5α-androstan-17-one with RT–26.58 (fig. 6) and Acetic acid, 10,13-dimethyl-2-oxo-2,3,4,7,8,9,10,11,12,13,14,15,16,17-tetra decahydro-1H-cyclopenta [a] phenanthren-17-yl ester with RT–23.37 (fig. 7) is reported newly in the DCM extract of *CT*.

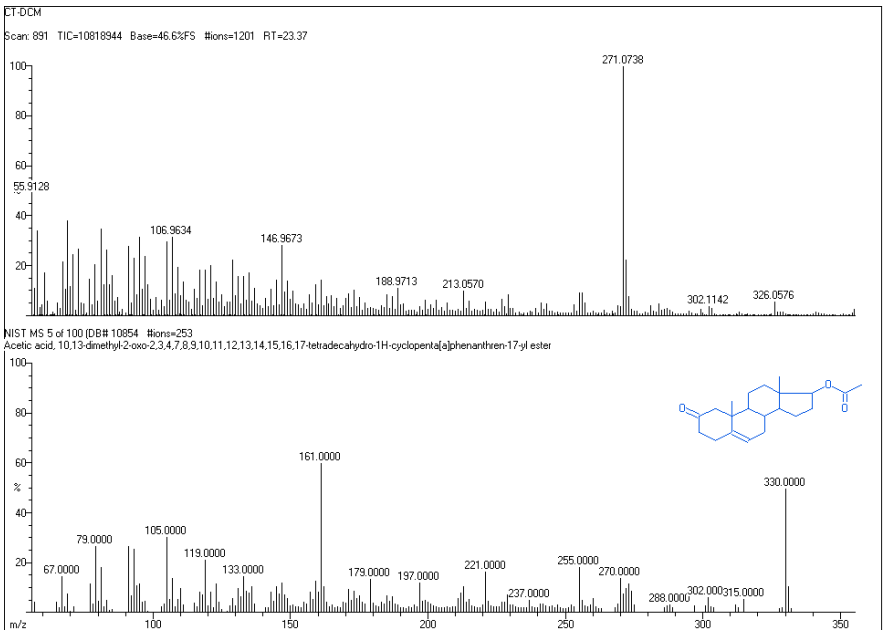

Fig. 7: Mass spectra of Acetic acid, 10,13-dimethyl-2-oxo-2,3,4,7,8,9,10,11,12,13,14,15,16,17-tetra decahydro-1H-cyclopenta[a]phenanthren-17-yl ester

GC-MS Chromatogram of MET extract of *CT* (fig. 8) representing 16.28–Tridecanedial, 17.28–Pentadecanoic acid, 14-methyl-, methyl ester, 18.18–n-hexadecanoic acid, 19.05–10-octadecenoic acid methyl ester, 19.2–Heptadecanoic acid,16-methyl-,methyl ester, 19.97–Hexadecanoic acid,14-methyl-,methylester, 20.98–16-octadecenoic acid, methyl ester, 23.02–Cyclopropaneoctanoic acid, 2-octyl-, methyl ester, cis, 26–Oxopowelline methane.

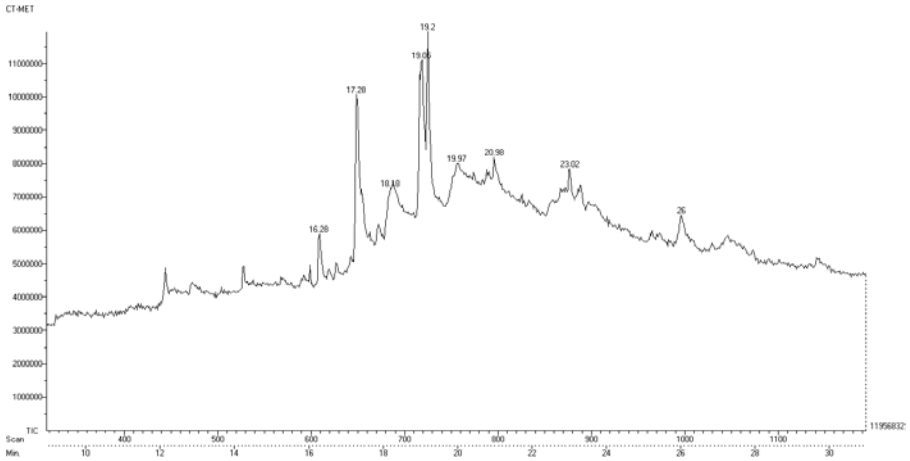

Fig. 8: GC-MS Chromatogram of MET extract of *CT*

The various elements present in *CT* leaf powder were investigated by XRF analysis. They were–Aluminum (0.094%), Calcium (2.378%), Chlorine (0.050%), Copper (0.031%), Potassium (1.71%), Iron (0.532%), Magnesium (0.1%), Manganese (0.199%), Sodium (0.1%), Phosphorus (0.134%), Sulphur (0.439%), Silicon (0.227%) and Titanium (0.031%). Out of these, Calcium (Ca), Potassium (K), Iron (Fe) and Sulphur (S) were found to be major elements and Titanium (Ti) was found to be a minor element in *CT*.

Previous studies reported the presence of biological important compounds in cinnamomum oil and in bark. 63 compounds were identified from water–distilled essential oil of *CT*. Out of these, β–caryophyllene (25.3%), linalool (13.4%) and caryophyllene oxide (10.3%) were considered as the main constituents [14].

Eugenol was identified as a major component in leaf powder and essential oils of CT [15, 16].In correlation, we have observed the presence of eugenol (Phenol,2-methoxy-3-[2-propenyl]-) as a major component in HEX and DCM extracts of *CT*.

Furthermore 22 potential components were identified in the essential oil of cinnamon bark oil utilizing specific reverse phased HPLC method [17],

Overall 31 compounds are reported in the HEX, DCM and MET extracts of *CT*. Out of these, eugenol is the major component present in the HEX and DCM extracts of CT. 2 compounds namely 2,6,10-trimethyl-12-oxatricyclo[7.3.0.0{1,6}]tridec-2-ene, Hexa hydro pyridine, 4-[4,5-dimethoxyphenyl]-in HEX extract and 3 compounds in DCM extract namely 6á,19-CycloAndrost-4-ene-3,17-dione, 5-chloro-3β-hydroxy-6β-nitro-5α-androstan-17-one, Acetic acid, 10,13 -dimethyl-2-oxo-2,3,4,7,8,9,10,11,12,13,14,15,16,17-tetradeca hydro -1H cyclopenta[a] phenanthren-17-yl ester are newly reported. Altogether, 13 elements were present in *CT*.

ACKNOWLEDGEMENT

We acknowledge Sophisticated Analytical Instrument Facility (SAIF), IIT Madras for performing GC-MS analysis. We are very grateful to Central Instrumentation Facility (CIF), Pondicherry University of availing XRF facility. We thank Inter–Disciplinary Program in Life Sciences (IPLS) of availing rota vapor facility.

Abbreviation

Cinnamomum tamala–*CT*, hexane–HEX, dichloromethane–DCM, methanol–MET, Gas chromatography mass spectrometry–GC-MS, X Ray Fluorescence–XRF, Reactive Oxygen Species–ROS, Reactive Nitrogen Species–RNS, National Institute of Standards and Technology–NIST.

CONFLICT OF INTERESTS

We declare that we have no conflict of interest

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