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GCMS analysis of Phyto Components of the musky smelling Dendrobium –*Dendrobium moschatum*

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ABSTRACT

The aim of the research is to analyse to phytocomponent from the acetone extract of *Dendrobium moschatum* leaves by GC-MS. GC-MS analysis of acetone extract was done by standard protocol using the equipment GC–HRMS (IIT Bombay), while the mass spectra of the compounds found in the extract was matched with the National Institute of Standards and Technology (NIST) library. The GC-MS analysis provided a variety of peaks determining the presence of different compounds in acetone extracts of *Dendrobium moschatum* namely coumarin, oxalic acid, palmitin, dihydrocoumarin, 2,4-dimethyl-2-pentanol, sulfurous, 2-benzedicarboxylic acid, bis (2-methylpropyl) ester, 1-iodo-2-methylnonane, palmitic acid. Qualitative phytochemical screening of the acetone extract of the leaves revealed the presence of many compounds such as flavonoids, tannins, saponins, alkaloids, glycosides, steroids and phenols. These findings support the traditional use of *Dendrobium moschatum* in various disorders.

Key word : *GC-MS analysis, Dendrobium moschatum, Phytocomponents*

Introduction

The family Orchidaceae forms one of world's largest Monocotyledonous flowering plants of angiosperms. Orchids are the most beautiful creation of the nature, as they have diverse shapes, forms and colours, they are considered to be the most highly evolved in floral specialization. In India, the family is represented by 1200sp. 170 genera (Sathish Kumar and Monilal, 1994). North east India is known to be an Orchid hotspot with nearly 72% of the total orchids found in India which are reported from this region (Barua, 2001). Orchids are commonly known for their ornamental value but many orchids are used as traditional medicine for the treatment of several ailments. 'Shihu', i.e the dried or fresh stems of several *Dendrobium* species (Orchidaceae), is widely used in traditional Chinese and folk medicines as tonic for the treatment of various diseases, such as chronic atrophic gastritis, diabetes, skin aging and cardiovascular diseases (Hu *et al*., 2012). Chinese Materia Medica stated that *Dendrobium nobile* is used in freshly cut wounds for healing (Sahaya *et al*., 2012). Dendrobium species (orchidaceae), locally known as "Shihu" in China; which is widely distributed throughout Asia, Europe and Australia by more than 1100 species. There are 74 species and 2 variations of *Dendrobium* plants found in China and about 30 species of them are used in traditional or folk medicine for anti-pyretic, eyes-benefiting, immunemodulatory purposes, etc(Commission of Chinese Pharmacopoeia, 2005). *Dendrobium moschatum* is commonly known as musk orchid or musky smelling *Dendrobium*, it is a native species to Himalayan region. The present research was carried out to determine the possible phytochemical components present in the leaf extract of *Dendrobium moschatum* with the aid of GC-

MS Technique.

Materials and Methods

Collection of the plant material

The leaves of *Dendrobium moschatum* were collected in March 2019 from plant conservation and propagation centre, Doomdooma, Assam, India. The plant was identified and authenticated at Department of Life Sciences, Dibrugarh University, Dibrugah, Assam, India.

Preparation of plant sample

The plant material (leaves) of *Dendrobium moschatum* was collected, healthy leaves were selected, washed, crushed by hand and was shade dried on the laboratory for 7 days. The dried leaves were ground into coarse powder using electric grinder. The coarse powder plant materials was dried and stored in air tight bottle for chemical analysis. 20g of the powdered plant sample was soaked in 200 mL of acetone for 24 hours, thereafter it was filtered using Whatmann No 1 filter paper of 185 mm size. The acetone extract was dried on water bath at 60 °C. GC-MS analysis of the dried acetone extract was further carried out.

Identification of components

Interpretation on mass spectrum GC-MS was conducted using the database of National Institute Standard and Technology (NIST) having more than 62,000 patterns. The spectrum of the unknown component was compared with the spectrum of the known components stored in the NIST library. The name, molecular weight and structure of the components of the test materials were ascertained. The biological activities listed are based on Dr. Duke's Phytochemical and Ethno-botanical Databases by Dr. Jim Duke of the Agricultural Research Service/ USDA.

GC-MS analysis

The extract was dissolved in ethanol and mixture of solvents and then subjected to GC-MS analysis. Mixture of solvents involved toluene, chloroform, ethanol and ethyl acetate. The GC-MS of sample was carried out in Sophisticated Analytical Instrument Facility (SAIF), IIT Bombay, Powai, Mumbai. Agilent 7890 instrument for GC and Joel Accu TOF GCV instrument for MS were used. The inert gas helium (99.999%) was used as carrier gas with the flow rate of 1 mL/min. HP5 column with specification length 30 mm, internal diameter 0.32 mm, film of 0.25 mm and temperature limit -60 °C to 325 °C (350 °C) was used. The total run time of GC was 35 minutes. The oven temperature raise from 70 °C upto 280 °C with the rate of 8 °C per min rise in temperature. The sample size of 4µL was injected through the injector. The MS was taken at 70eV. The identification of compounds was done by comparing the spectrum of unknown compounds with the spectrum of known compounds in their library and the name, molecular weight and structure were probably determined.

Results

The GC-MS analysis of Dendrobium moschatum leaves revealed the presence of sixteen phytocomponents. The identified phytocomponents possess many biological properties such as antioxidant activity, antimicrobial activity, anti-inflammatory activity, anticancer activity and anti HIV activity. The name of the compound, retention time (RT), molecular formula, molecular weight (MW) and concentration (%) are shown in Table 1. Biological activities of the phytocomponents are represented in Table 2. The GC chromatogram of the leaf extract is presented in Fig. 1. The prevailing compounds were 2-Pentanol, 2,4-dimethyl, 2- Pentanone,4-hydroxy-4-methyl, 2H-1-Benzopyran-2-one, 3,4-dihydro, Coumarin, 1-Iodo-2-methylnonane, 1-Iodo-2-methylundecane, 1,2-Benzenedicarboxylic acid, bis(2-methylpropyl)ester, Oxalic acid,allyl nonyl ester, Sulfurous acid, dodecyl 2-propyl ester, n-Hexadecanoic acid, Sulfurous acid, 2-ethylhexyl nonyl ester, Hexadecanoic acid, 2-hydroxy-1-(hydroxymethyl) ethyl ester, Oxalic acid, allyl pentadecyl ester.

Discussion

Plants have an important source of phytocomponents. They are source of many potential drugs mainly on traditional and folk medicines. Recently, the study of the organic compounds and their activity from plants has increased. More than 7000 different bioactive compounds are considered be polyphenols (Bravo,1998) and these phenolic compounds were reported to have many pharmaco-

Table 1. Phytocomponents identified in the acetone extract of *Dendrobium moschatum*

Peak	Retention time (min)	Name of the compound	Molecular formula	Molecular weight	Peak area (intensity*sec)
1	4.27	2-Pentanol, 2,4-dimethyl	$C_7H_{16}O$	116	2890410.94
2	10.45	2- Pentanone,4-hydroxy-4-methyl	$C_6H_{12}O_2$	116	932284.39
3	14.04	2H-1-Benzopyran-2-one, 3,4-dihydro	$C_9H_8O_2$	148	69524632.49
4	14.99	Coumarin	$C_9H_6O_2$	146	21643965.68
5	16.00	-	-		953121.68
6	18.40	1-Iodo-2-methylnonane	$C_{10}H_{21}I$	268	882020.53
7	19.75	1-Iodo-2-methylundecane	$C_{12}H_{25}I$	296	882155.07
9	20.31	1,2-Benzenedicarboxylic acid,bis(2-methylpropyl) ester	$C_{16}H_{22}O_4$	278	2242267.24
9	20.61	Oxalic acid,allyl nonyl ester	$C_{14}H_{24}O_4$	256	5689564.75
10	21.33	Cyclopentaneudecanoic acid, methyl ester	$C_{17}H_{32}O_2$	268	835613.26
11	22.41	Sulfurous acid, dodecyl 2-propyl ester	$C_{15}H_{32}O_3S$	292	3135021.04
12	22.62	n-Hexadecanoic acid	$C_{16}H_{32}O_2$	256	1968321.11
13	24.10	Sulfurous acid, 2-ethylhexyl nonyl ester	$C_{17}H_{36}O_3S$	320	929153.03
14	25.78	Sulfurous acid, 2-propyl tetradecyl ester	$C_{17}H_{36}O_3S$	320.5	1138852.50
15	29.42	Hexadecanoic acid, 2-hydroxy-1-(hydroxymethyl) ethyl ester	$C_{19}H_{38}O_4$	330	646473.96
16	29.73	Oxalic acid, allyl pentadecyl ester	$C_{20}H_{36}O_4$	340	4109063.17

Table 2. Biological activity of phytocomponents in the acetone extract of *Dendrobium moschatum*

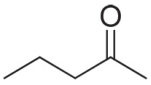
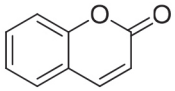
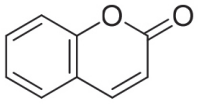
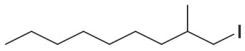
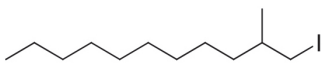
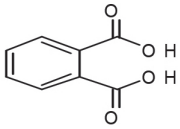
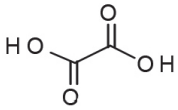
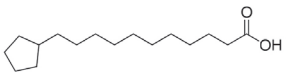
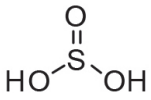
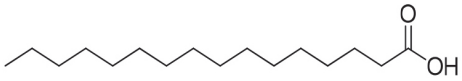
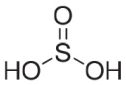
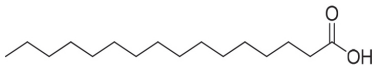
Sl. No.	Name of the compound	Structure	Biological activity
1	2-Pentanone,4-hydroxy-4-methyl		17-beta-hydroxysteroid dehydrogenase-inhibitor, anticancer activity
2	2H-1-Benzopyran-2-one, 3,4-dihydro		Anti-HIV-Integrase
3	Coumarin		Treatment of asthma and lymphedema, anti-inflamatory, antibacterial, anticancer, antihypertensive, antioxidant
4	1-Iodo-2-methylnonane		17-beta-hydroxysteroid dehydrogenase-inhibitor, anticancer, Anti-HIV-Integrase, antitumor, antibacterial, antioxidant
5	1-Iodo-2-methylundecane		iodothyronine-deiodinase-inhibitor, antimicrobial
6	1,2-Benzenedicarboxylic acid, bis(2-methylpropyl)ester		Inhibit the production of uric acid
7	Oxalic acid,allyl nonyl ester		Inhibit the production of uric acid

Table 2. Biological activity of phytocomponents in the acetone extract of *Dendrobium moschatum*

Sl. No.	Name of the compound	Structure	Biological activity
8	Cyclopentaneundecanoic acid, methyl ester		Inhibit the production of uric acid
9	Sulfurous acid, dodecyl 2-propyl ester		Inhibit the production of uric acid
10	n-Hexadecanoic acid		Antioxidant, hypocholesterolemic nematicide, pesticide, anti-androgenic flavor, hemolytic, 5- Alpha reductase inhibitor
11	Sulfurous acid, 2-propyl tetradecyl ester		Inhibit the production of uric acid
12	Hexadecanoic acid, 2-hydroxy-1-(hydroxymethyl) ethyl ester		17-beta-hydroxysteroid dehydrogenase-inhibitor, breast cancer,prostrate cancer

Source: Duke's Phytochemical and ethno- botanical database

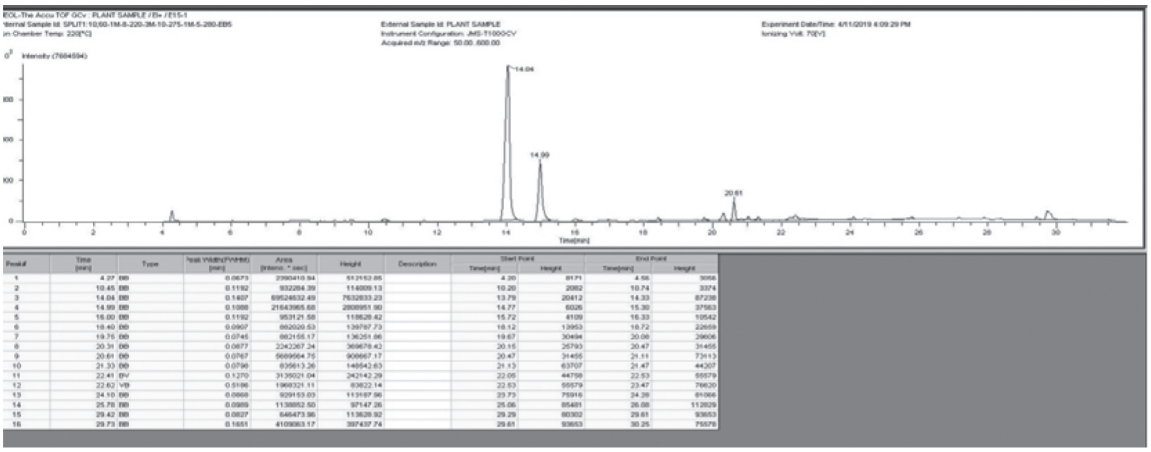


Fig. 1. GC-MS chromatogram of acetone extract of *Dendrobium moschatum* leaves

logical properties (e.g. anticarcinogenic and antimicrobial activities) (Kono *et al.*, 1995; Esposito *et al.*, 2002; Ouslatia *et al.*, 2012). Fatty acids such as palmitic acid and 1 phthalate derivative are alkaloids which have activities such as antimicrobial (McGaw *et al.*, 2002).

In the present study, the GCMS analysis of acetone extract of leaves of *Dendrobium moschatum* showed the presence of various components and these components have been shown to possess antioxidant, wound healing, antimicrobial and anti-inflammatory activity. The leaves of *Dendrobium moschatum* contains fatty acids namely palmitic acid and 1 phthalate which are alkaloids and have medicinal properties. Coumarin derivatives are used as an anti-HIV agents. Diisobutyl phthalate, Allyl nonyl oxalate, Methyl dihydrodnocarpate, Sulfurous acid, dodecyl 2-propyl ester, Sulfurous acid, 2-propyl tetradecyl ester inhibit the production of uric acid in human body. The antioxidant activity due to the presence of phytocomponents like n-Hexadecanoic acid, 1-Iodo-2-methylnonane

which might be helpful in preventing or slowing the progress of various oxidative stress related diseases. These were accomplished as reverse transcriptase inhibitors, protease inhibitor, and integrase inhibitors (Kostova *et al*. 2006). The leaves and stems of a number of Dendrobium species (orchidceae) are used as health foods and nutrients (Bao, Shun and Chen, 2001). Previous studies have led to isolation of a series of diverse compounds like alkaloids, flurenones, sesquiterpenoids, bibenzyls and phenanthrene were found to possess antitumor and antimutagenic activities (Chen *et al.*, 1994; Fan *et al.*, 2001)

Conclusion

The present study revealed the presence of many important phytocomponents in the leaf extracts. The plant can be a source material to herbal drug industry. Plant derived phytocomponents have significant contribution to human health and that can be used for the development of therapeutic phytomedicines for the therapy and treatments. This type of GC-MS analysis is the first step towards understanding the nature of active principles in this medicinal plant and this type of study will be helpful for further detailed study.

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