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GC-MS ANALYSIS OF BIOACTIVE COMPOUNDS FROM ETHANOLIC EXTRACT OF WHOLE PLANT OF *MOLLUGO OPPOSITIFOLIA* L. AND THEIR PHARMACOLOGICAL ACTIVITIES

Anju G. Nagannawar * and M. Jayaraj

P. G. Department of Botany, Karnatak University, Dharwad - 580003, Karnataka, India.

Keywords:

Bioactive compounds, Ethanoic extract, GC-MS, *Mollugo oppositifolia* L., Pharmacological activity

Correspondence to Author:
Anju G. Nagannawar

Research Scholar,
P.G. Department of Botany,
Karnatak University Dharwad - 580003, Karnataka, India.

E-mail: 2016anju@gmail.com

ABSTRACT: Ethanolic extract of the whole plant of *Mollugo oppositifolia* L. of Molluginaceae has been analyzed by using GC-MS for Bioactive compounds and for their pharmacological activities. GC-MS showed 32 compounds and is confirmed with the help of the database of NIST. Out of these, seven major Bioactive compounds are identified based on their retention time and peak area in GC-MS chromatogram. Among these seven bioactive compounds, Estran-3-one is highest with 33.5%, and dodecanoic acid is lowest with 5.75%. hexadecanoic acid, stigmasterol, estran-3-one, and 8, 11, 14-eicosatrienoic acid are having a higher number of pharmacological activities.

INTRODUCTION: Traditional medicinal plants have been identified as a part of the evolution of human healthcare for thousands of years. The medicinal plants are useful for healing as well as for the curing of human diseases because of the presence of phytochemical constituents [17]. Plants have the capacity of synthesizing the organic compounds and are called secondary metabolites, and they have unique complex structures. The secondary metabolites are used in treating chronic as well as infectious diseases [7]. They are the vital source of chemical compounds of biological and pharmacological importance.

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World Health Organization (WHO) is to encourage, promote, and facilitate effective herbal medicine for the primary use in developing countries for different health programs. Different biological activities like antioxidant, antimicrobial, anxiolytic, and anti-inflammatory are due to the presence of the bioactive compounds [17].

Mollugo oppositifolia L., (Syn.: *Glinus oppositifolius* L.) belongs to family Molluginaceae, is an indigenous herb, commonly known as Slender carpetweed or 'Papait' and grows throughout South India **Fig. 1**. It is a diffuse, prostrate or ascending annual herb found to be growing in Assam, West Bengal, Delhi, Gujarat, and South India [29, 21]. It is a highly valued medicinal herb having anti-oxidant, anthelmintic, hepatoprotective, analgesic, anti-microbial, anti-inflammatory, antiseptic, and anti-hyperglycemic activities. Traditionally, the plant extract is used in stomach ache, as carminative and juice is applied for dermatitis and other skin

diseases; it is also useful as a bitter tonic for liver disorders; the plant is administered for suppression of the lochia and when applied warm and moistened with a little castor oil; is reckoned good application for earache [25].

FIG. 1: HABIT- *MOLLUGO OPPOSITIFOLIA* L.

The plant is also utilized as a common dietary principle, mainly in South India. Gas chromatography-mass spectrometry is an integral part of research associated with medicinal chemistry, pharmaceutical analysis, pharmacognosy, pharmaceutical process control, and pharmaceutical biotechnology. The present study is undertaken to know bioactive compounds through the GC-MS profile of ethanolic extract of whole plant *Mollugo oppositifolia* L. and their pharmacological activities.

MATERIALS AND METHODS:

Material: The *Mollugo oppositifolia* L. (Voucher specimen no: KUD/BOT/AN/JM/001), the plant was collected from Karnatak University Campus, Dharwad, Karnataka. The plant was washed with running tap water and later shade dried at room temperature. The dried plant was powdered using an electric blender. The powder thus obtained was sieved and stored in an airtight container at room temperature for further analysis.

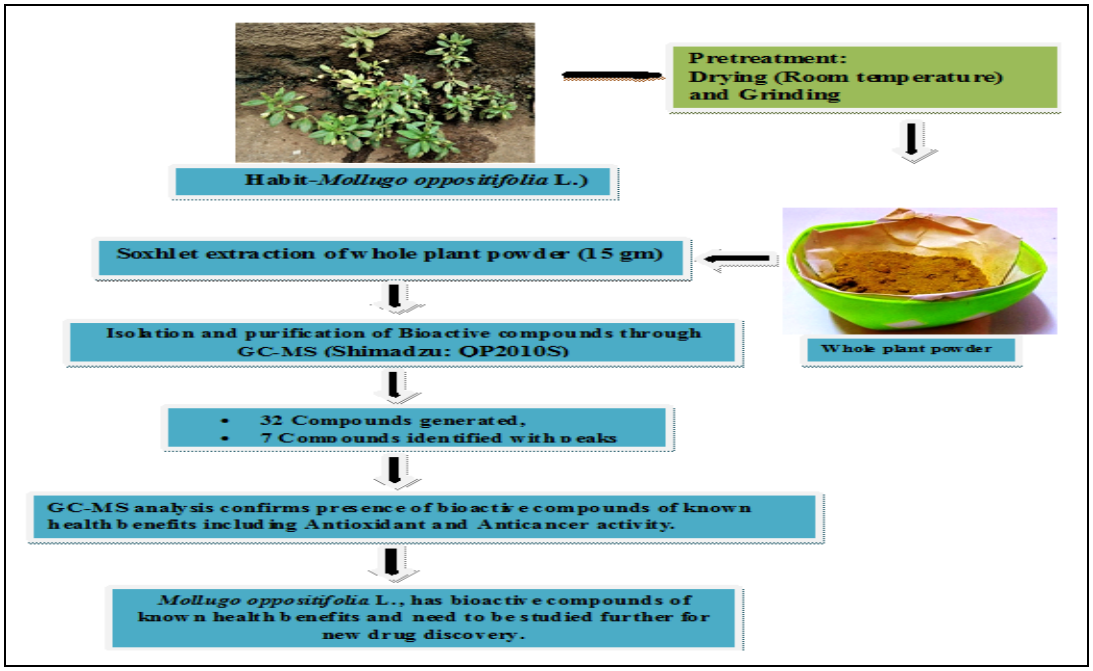


FIG. 2: SCHEMATIC REPRESENTATION OF THE PROTOCOL FOR GC-MS ANALYSIS OF *MOLLUGO OPPOSITIFOLIA* L.

Whole Plant Extract: About 15 gms of the shade dried plant finely powdered and was subjected to extraction with ethanol (250 ml) using the Soxhlet apparatus. The extract was used for GC-MS analysis to identify the bioactive components in **Fig. 2**.

GC-MS Analysis: The analysis was performed using a (GC-MS Shimadzu): QP2010S fitted with a 1.4 µm column Rxi-5si1MS 30-meter length, 0.25 mm inner diameter, and 0.25 µm film thickness. Carrier gas helium with a flow rate of 0.98 ml/min; column temperature 80 ºC; initial temperature 70 ºC, injector temperature 260 ºC and detector temperature 300 ºC, followed by a linear programmed temperature from 70- 280 ºC at a rate of 10 ºC/min, operating in electron impact mode. The samples were injected in splitless mode, and interface temperature was kept at 280 ºC. The pressure of the carrier gas was kept at 63.6 kPa.

The constituents were determined based on the Retention time of a series and identification of each component and were confirmed with the comparison of its retention index with the database [3, 10].

Identification of Components: Bioactive compounds are identified based on the GC-MS using the database of the National Institute Standard and Technology (NIST). The spectrum of the unknown components was compared with a spectrum of known components that were stored in the NIST library. The name, molecular weight, and molecular formula of the components of the test material were tabulated in **Table 1**.

Results: The GC-MS chromatogram of the ethanolic extract of the whole plant of *Mollugo oppositifolia* L. showed 7 peaks indicating the presence of seven compounds. **Fig. 3** and Mass spectra of the identified bioactive compounds from the ethanolic extract **Fig. 4**. The active principles with their peak, retention time (RT), area (%), height (%), molecular formula and molecular weight are presented in **Table 1**.

The GC-MS analysis revealed the presence of seven major bioactive compounds in the ethanol extract of the whole plant, Hexadecanoic acid, Dodecanoic acid, Heptanoic acid, Stigmasterol, Isobornyl acetate, 8, 11, 14-Eicosatrienoic acid, and Estran-3-one. The GC-MS identified bioactive compounds with their pharmacological activities and are recorded in **Table 2**.

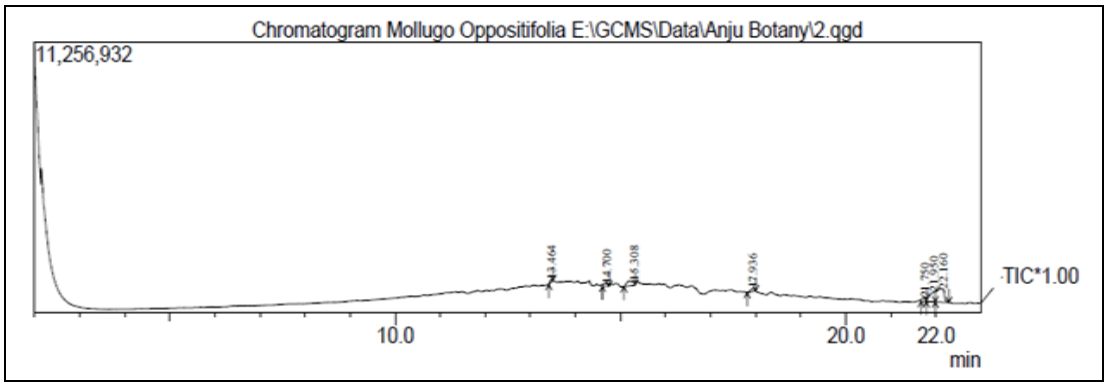
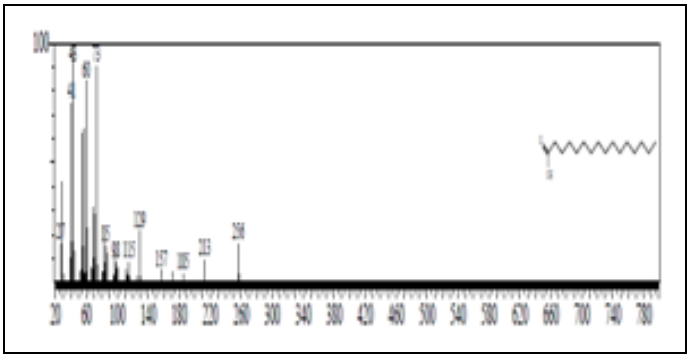
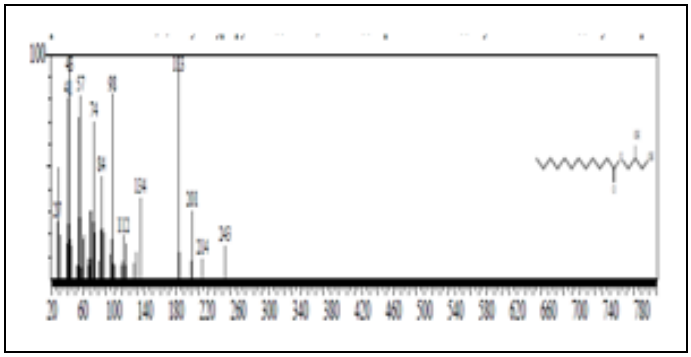


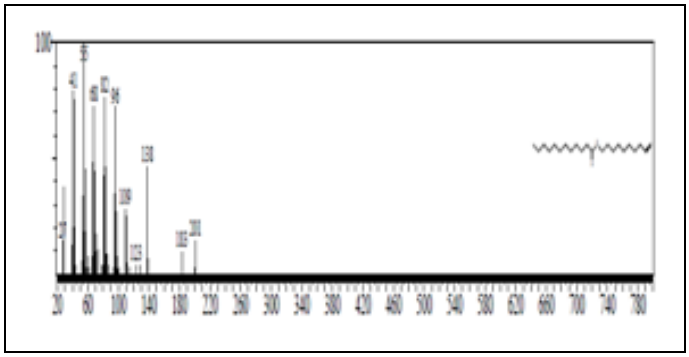
FIG. 3: CHROMATOGRAM OF WHOLE PLANT ETHANOLIC EXTRACT OF *MOLLUGO OPPOSITIFOLIA* L.



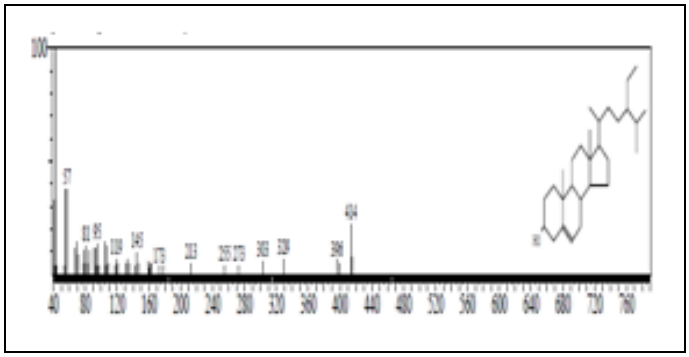
HEXADECANOIC ACID



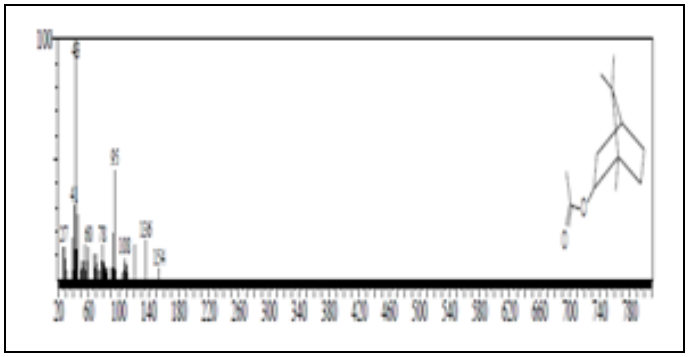
DODECANOIC ACID



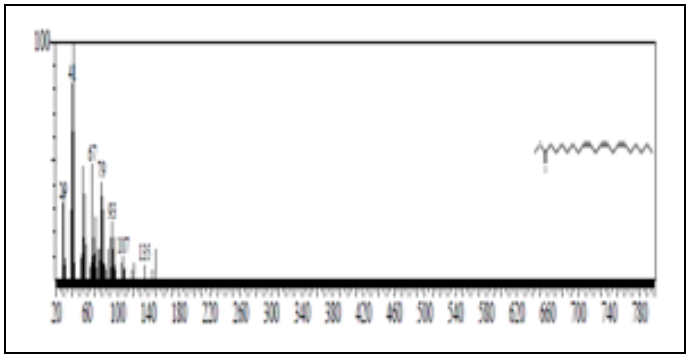
HEPTANOIC ACID



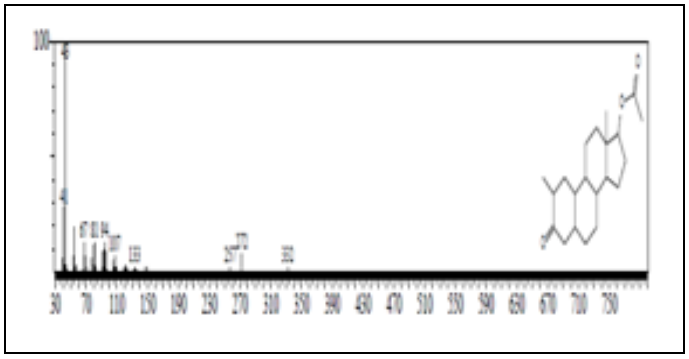
STIGMASTEROL



ISOBORNYL ACETATE



8, 11, 14-EICOSATRIENOIC



ESTRAN-3-ONE

FIG. 4: MASS SPECTRA OF IDENTIFIED COMPOUNDS FROM ETHANOLIC EXTRACT OF THE WHOLE PLANT OF *MOLLUGO OPPOSITIFOLIA* L.

TABLE 1: THE GC-MS ANALYSIS OF BIOACTIVE COMPOUNDS IN THE WHOLE PLANT ETHANOLIC EXTRACT OF *MOLLOGO OPPOSITIFOLIA* L.

Peak	R. Time	Area %	Height %	Molecular formula	Molecular weight (g/mol)	Name of the compound
1	13.464	2.69	6.54	$C_{16}H_{32}O_2$	256.4	Hexadecanoic acid (Palmitic acid)
2	14.700	5.83	5.75	$C_{12}H_{24}O_2$	200.3178	Dodecanoic acid
3	15.308	14.48	11.66	$C_7H_{14}O_2$	130.1849	Heptanoic acid
4	17.936	4.71	7.67	$C_{29}H_{48}O$	412.69	Stigmasterol
5	21.750	6.12	9.45	$C_{12}H_{20}O_2$	196.28	Isobornyl acetate
6	21.950	24.20	25.42	C20H34O2	306.5	8, 11, 14-Eicosatrienoic acid
7	22.160	41.96	33.51	$C_{18}H_{28}O_2$	276.4	Estran-3-one

TABLE 2: PHARMACOLOGICAL ACTIVITY OF BIOACTIVE COMPOUNDS IN THE WHOLE PLANT ETHANOLIC EXTRACT OF *MOLLUGO OPPOSITIFOLIA* L.

S. no.	Compounds	Pharmacological activity
1	Hexadecanoic acid	Antioxidant [11], Anti-inflammatory [4], Anthelmintic activities [3], Antibacterial, Antiallergic [11], Hypocholesterolemic, Pesticide, Flavour, Haemolytic, 5-alpha-reductase inhibitor [8, 15], Antifibrinolytic [20], Antialopecic, Antiandrogenic, Lubricant, Nematicide, Pesticide, Propecic, Soap [16].
2	Dodecanoic acid (lauric acid)	Antioxidant [28] and Cyclooxygenase activity [27], Anticoronary, Antiandrogenic, 5-Alpha reductase inhibitor [1], Antifungal and Antibacterial [26], Antimicrobial [22].
3	Heptanoic acid	Antioxidant [18, 13], Antimicrobial [23].
4	Stigmasterol	Antioxidant, Antimicrobial, Anticancer, Anti-inflammatory, Diuretic [17], Hypoglycemic and thyroid inhibiting properties, precursor of progesterone, Antiarthritic, Antiasthma [11, 8], Antiperoxidative [2], Antifungal activity [4], Antitumor activity[5].
5	Isobornyl acetate	Antioxidant and Antifungal [22].
6	8, 11, 14-Eicosatrienoic acid (dihomo-gamma-linolenic acid(DGLA)	Antioxidant and Cyclooxygenase activity [27], Cardioprotective [9], Inhibitor of platelet aggregation provoked by ADP [19].
7	Estran-3-one	Progestational and Dehydrogenase [12], Antisickling activity and good binding affinity [24], 17-beta-hydroxysteroid dehydrogenase-inhibitor (prevent breast, ovarian, and endometrium cancers) and androgen-sensitive pathologies (prostate cancer, benign prostatic hyperplasia, acne, hirsutism) [6].

DISCUSSION: The GC-MS analysis revealed 32 compounds out of which seven major bioactive compounds are identified. The Estran-3-one (33.51%) is the highest chemical compound and Dodecanoic acid (5.75%) as the lowest chemical compound. The compound Hexadecanoic acid (6.54 %), Dodecenoic acid (5.75%), and Heptanoic acid (11.66%) showed pharmacological activity as reported in the plants of *Wattakaka volubilis* [28], Asclepias curassavica [8], Pyrostegia venusta 18 and Cassia italic1. Similarly, Stigmasterol (7.67%), Isobornyl acetate (9.45%), 8, 11, 14-Eicosatrienoic acid (25.42%) and Estran-3-one (33.51%) also have different pharmacological activities as reported for Bulbine natalensis [14], Achillea millefolium [22], Neibuhria apetala Dunn 9 and Monodora myristica [24] (African nutmeg).

CONCLUSION: The ethanolic extract of the whole plant of *Mollugo oppositifolia* L. has seven different bioactive compounds with their pharmacological activities. Each chemical compound produced by this plant may be used in the pharmaceutical industry and for medicinal usage, and each chemical compound can be extracted individually and may be used in clinical trials to check the efficiency and to develop a new allopathic drug from a crude herbal drug. Gas chromatography-mass spectrometry is an integral part of research associated with medicinal chemistry, pharmaceutical analysis, pharmaco-gnosy, pharmaceutical process control, and pharmaceutical biotechnology. The plant *Mollugo oppositifolia* L. may be of great interest for the pharmaceutical industry, and medicinal research and each bioactive compound can be extracted individually and used in clinical trials to check the efficiency and to develop a new drug from a crude drug.The GC-MS profile of *Mollugo oppositifolia* L. will also be a part of a database of bioactive compounds of natural drugs.

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CONFLICTS OF INTEREST: The author declares that there is no conflict of interest.

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