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GC-MS and FTIR analysis of methanolic leaf extract of *Rhynchosia minima* (L.) DC.

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ABSTRACT

The current analysis was carried out to determine the chemical components in the leaves of *R. minima* (L.) DC. The GC-MS analysis of methanolic leaves extract of *R. Minima* indicated the presence of 19 compounds. The prevailing compounds of *R. minima* leaves were 1Pentadecene (14.31), alpha. Bisabolol (10.39%), 1Heptadecene (9.78%), Cyclohexene,4 (1,5dimethyl,1,4hexadienyl (7.06%), 3Hexadecene (Z) (8.10%), Caryophyllene (6.58%), Neophytadiene (5.16%), Humulene (1.91%), Naphthalene,1,2,3,5,6,8 a-hexahydro-4,7-dimethyl (3.72%), Hexadecanoic acid, methyl ester (2.09%), Pentadecanone (3.13%), 8-Octadecanone (4.02%),1-Nonadecene (4.16%), Spiro[4.5]dec-6-en-8-one,1,7-dimethyl-4-(1-methylethyl (2.97%), Neophytadiene (2.24%),(E)-beta.-Famesene (1.92%), Cyclohexene,4-[(1E)-1,5-dimethyl-1,4-hexadien (1.80%), Cyclohexane,octyl (1.45%), beta Bisabolene (9.21%). These compounds have antibacterial, antifungal, antioxidant, hemolytic, insecticidal, and lubricant activity. Fourier Transform Infra-Red Spectroscopy (FTIR) leaf analysis of *R. minima* shows lipid, protein, phosphate ion, carboxylic acid, hydroxy compound, aliphatic bromo compounds. The present study revealed that *R. minima* leaves represent various types of bioactive compounds. 1-Heptadecene with antibiotic activity, 8-Octadecanone shows antimicrobial activity and hexadecanoic acid, nematocide, antibiotic, antioxidant, hypocholesterolemic production of methyl ester.

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INTRODUCTION

The genus *Rhynchosia* (Fabaceae) belongs to the family Fabaceae (Leguminosae), the subfamily Papilionoideae, the tribe Phaseoleae, the subtribe Cajaninae. The genus is described in India by 25 species, as well as one variety and one subspecies, 7 of which are endemic to India. In India, there is a great diversity of the species of *Rhynchosia*, about 60%, found in the Eastern Ghat [1].

With its various edible berries, and also great value in the indigenous medicine system, the family fabaceae has an economic significance. Many of the wild edible plant have both therapeutic and dietary function. Wild edible plant plays a significant role in human life, supplying nutrients, fibres, vitamins, essential fatty acids and improving dietary taste and colour. *R. minima* (L.) DC. Commonly referred to as Turvel is an annual twinning or trailing spread throughout India, Sri Lanka, and the United States [2]. The seeds are weaker and poisonous and the extract of seeds shows strong agglutinating activity on human RBC [3]. The medicine leaves of this plant are used as abortifacient in the folk tradition method. Decoction

prepared from leaves is used as an abortifacient by tribals in the North Maharashtra region [4]. The Sikkim tribals use plant leaves in the treatment of wounds, helminthic infection and abortion [5]. In the Saurashtra region of Gujarat, the aborigines use the leaves to treat asthma and piles [6]. Plant phytochemical experiments revealed the existence of ergoster, stigmaterol, lupeol, and steroidal glycoside [7]. The Leaves of *R. Minima* have significant anthelmintic activity [4]. *R. Minima* leaves essential therapeutic qualities such as contamination with helminths, cuts, asthma, piles and abortive substances [8]. In the case of gold nanoparticles *R. minima* mediated synthesis, the alkyne group, acyl halide, secondary amine in alkaloids and alkyl halides such as iodine and bromine compounds may be involved in the reduction of gold chloride into gold nanoparticles, these compounds may also serve as reducing and capping agents [9]. Preliminary phytochemical screening of the *R. minima* aqueous leaf extract indicated the presence of alkaloids, flavonoids, tannins, terpenoids and glycosides [4]. Medicinal plants have historically been an integral part of human life since ancient days. Because of their therapeutic selectivity, minute of side effects, inexpensive source and function as lead molecules for the development of new drugs, natural compounds are currently

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the main source for the modern drug discovery. *Rhynchosia* species (Fabaceae) grow widely in the world's tropical and subtropical areas. In herbal medicine, a few plants of this genus have been used to treat various conditions such as antibacterial, antidiabetic, abortive, wound healing, hepatoprotective, boil cure, rheumatic pain and skin infections [10]. Medicinal plants are a worthy source of biologically active compounds for the production over the past centuries of new therapeutic drug candidates [11-13]. Also today, plant species are commonly used by people in many countries as a cure for the treatment of different forms of diseases such as infectious, cardiovascular, diabetic, intestinal, renal, mental-nervous, dietary, respiratory, reproductive, neurological, skin infections and many wounds [14]. Therefore, the plants provide a valuable source of natural compounds and played a major role with scientifically enhanced effectiveness in the new drug development as well as less side effects [15]. Therefore, in terms of biological activity and drug discovery many researchers based their research attention on medicinal plants.

MATERIALS AND METHODS

Collection of Plant Material and Preparation of Methanol Extract

The plant materials of *R.minima* were collected from Kondi in Solapur District, Maharashtra. The identification of plant material was carried out by using flora of Kolhapur District [13]. The leaves were air dried at lab condition to avoid contamination and made fine powder by using mechanical grinder. Then the powder was used for extraction using the solvent methanol. The obtained extracts were filtered by using Whatman No.1 filter paper, concentrated

by using an evaporator at 40 °C and residual extracts were stored in the refrigerator at 4 °C in small and sterile amber colour glass bottles. This solution was further used for GC-MS analysis. Fine powder of leaves of *R. Minima* was used to FTIR analysis.

The GC-MS analysis was done using GCMS-TQ8050- Shimadzu (Japan). It has equipped with SH-Rxi-5 sil MS fused silica capillary column (0.25mm diameter and 0.25 mm thickness). Injection mode- split, Flow control mode – Pressure, Pressure-75.2 kPa, linear velocity-41.4 cm/sec, Purge flow-3.0 ml/min and Split ratio-(1.0). Helium gas (99.9%) was used as a carrier gas at constant flow rate. Identification of components is read on mass spectrum of GC-MS by using National institute of standard and techniques NIST-08 LIB and WILEY-08 L.

RESULTS AND DISCUSSION

The GCMS analysis of leaves of *R.minima* showed Nineteen compounds (Table 1). The major phytochemical components were: 1-Pentadecene (14.31%), alpha.-Bisabolol (10.39%), 1-Heptadecene (9.78%), Cyclohexene,4-(1,5-dimethyl-1,4-hexadienyl (7.06%), 3-Hexadecene,(Z)-(8.10%), Caryophyllene (6.58%), Neophytadiene (5.16%), Humulene (1.91%), Naphthalene,1,2,3,5,6,8 a-hexahydro-4,7-dimethyl (3.72%), Hexadecanoic acid, methyl ester (2.09%), Pentadecanone (3.13%), 8-Octadecanone (4.02%), 1-Nonadecene (4.16%) Spiro[4.5]dec-6-en-8-one,1,7-dimethyl-4-(1-methylethyl (2.97%), Neophytadiene (2.24%), (E)-.beta.-Famesene (1.92%), Cyclohexene,4-[(1E)-1,5-dimethyl-1,4-hexadienyl (1.80%), Cyclohexane,octyl (1.45%), beta-Bisabolene (9.21%) (Figure 1). Compounds 1-Heptadecene and 8-Octadecanone with antibiotic and antimicrobial activity

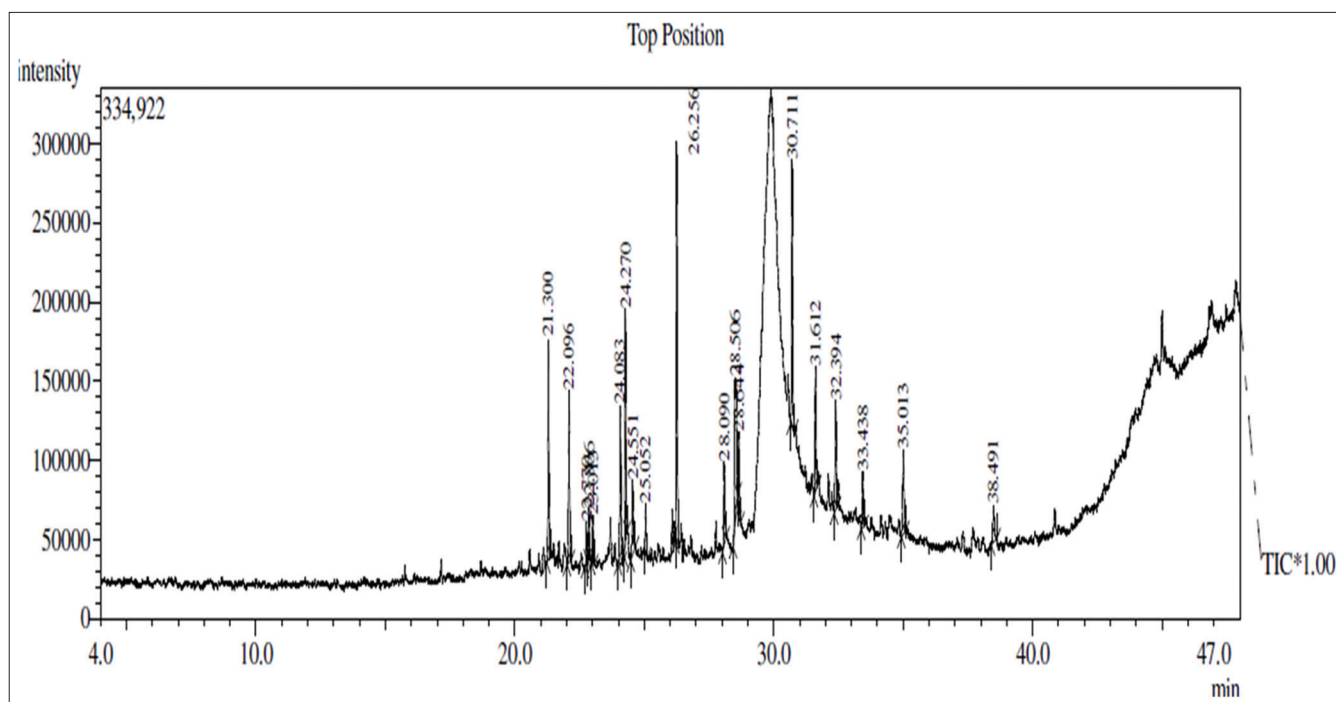


Figure 1: GC-MS chromatogram of methanolic extract of leaves of *R.minima*

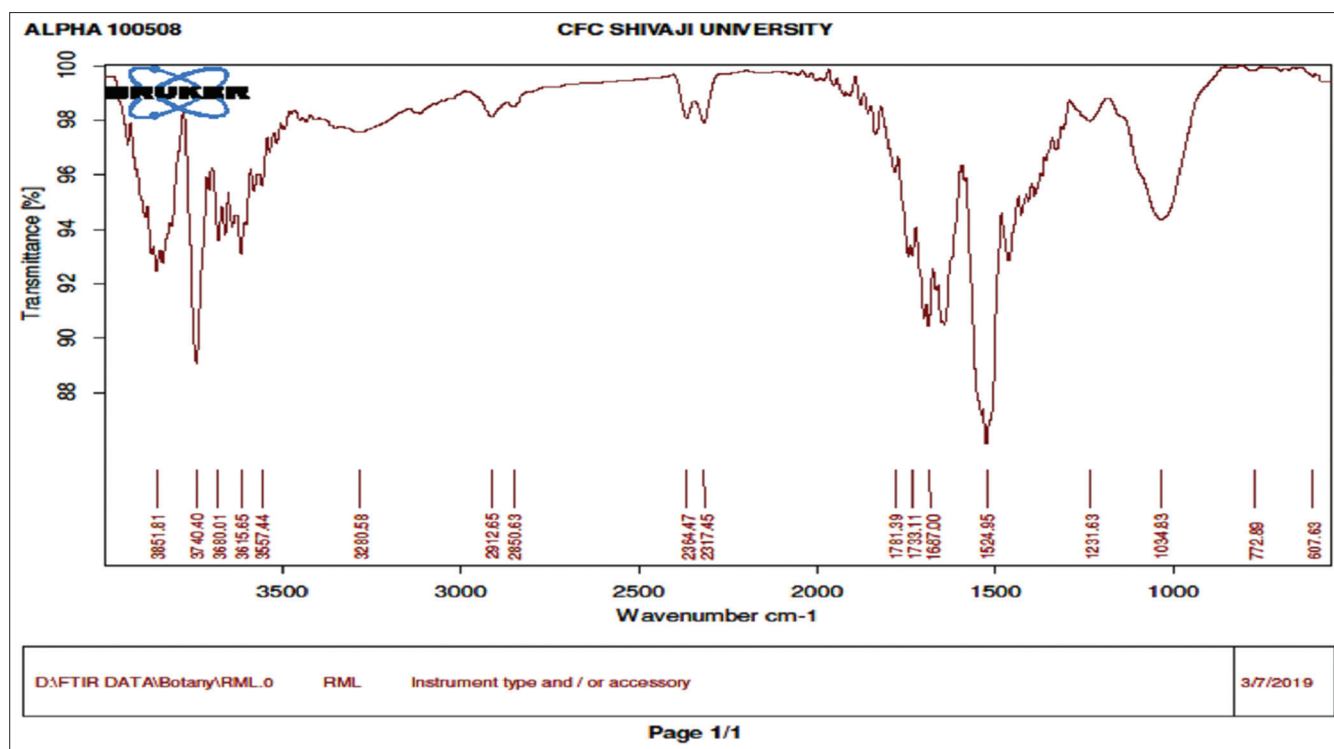


Figure 2: FTIR chromatogram of methanolic extract of Leaves of *R. minima*

Table 1: GC-MS analysis revealed the presence of bioactive compounds in the leaves of methanolic extract of *R. minima*

Sr No.	Name of compound	Retention time	% Peak area	Mol. formula	Mol. weight
1	3-Hexadecene, (Z)-	21.300	8.10	C16H32	224
2	Caryophyllene	22.096	6.58	C15H24	204
3	Cyclohexane, octyl-	22.770	1.45	C14H28	196
4	E)-.beta.-Farnesene	22.866	1.92	C15H24	204
5	Humulene	23.013	1.91	C15H24	204
6	Cyclohexene, 4-(1,5-dimethyl-1,4-hexadienyl	24.083	7.06	C15H24	204
7	.beta.-Bisabolene	24.270	9.21	C15H24	204
8	Naphthalene, 1,2,3,5,6,8a-hexahydro-4,7-dimethyl-1-(1-methylethyl)-, (1S-cis)	24.551	3.72	C15H24	204
9	Cyclohexene, 4-[(1E)-1,5-dimethyl-1,4-hexadien	25.052	1.80	C15H24	204
10	1-Pentadecene	26.256	14.31	C15H30	210
11	8-Pentadecanone	28.090	3.13	C15H30O	226
12	.alpha.-Bisabolo	28.506	10.39	C15H26O	222
13	Spiro[4.5]dec-6-en-8-one, 1,7-dimethyl-4-(1-methylethyl	28.644	2.97	C15H24O	220
14	1-Heptadecene	30.711	9.78	C17H34	238
15	Neophytadiene	31.612	5.16	C20H38	278
16	8-Octadecanone	32.394	4.02	C18H36O	268
17	Hexadecanoic acid, methyl ester	33.438	2.09	C17H34O2	270
18	1-Nonadecene	35.013	4.16	C19H38	266
19	Neophytadiene	38.491	2.24	C20H38	278

[16,17]. Hexadecanoic acid compound, nematicide methyl ester compound, insecticide, antibiotic, antioxidant, hypocholesterolemic activity [18]. Caryophyllene compound having anti-inflammatory activity [19]. Hexadecanoic acid phytochemical portion, methyl ester having anti-androgenic activity in Neolamarkia Cadamba leaf extract (Table 2). GC-MS study of Martynia Annu Linn methanol extract seeds having hexadecanoic acid, methyl ester compound. Gundidza et al. [21] studied antibacterial, antifungal and antioxidant activity and found that, *R. Minima* essential oil has average antibacterial activity of all reported bacterial species except

Clostridium perfringens and *Klebsiella pneumoniae* [21]. According to Bhakshu and Raju [22], the essential oil of *R. heynei* leaves exhibited a broad spectrum of antimicrobial activity. The screening showed that *Micrococcus luteus*, *Staphylococcus aureus* and *Pseudomonas aeruginosa* were the highest inhibitory activity followed by *Bacillus cereus*, *Candida tropicalis*, *C. albicans* and *Aspergillus niger* were immune to the oil examined. In the case of *R. minima* mediated synthesis of gold nanoparticles, the alkyne group, acyl halide, secondary amine in alkaloids and alkyl halides such as iodine and bromine compounds may be involved in reducing gold chloride into

Table 2: Activity of bioactive compound identified in the methanolic leaf extracts of *R. minima*

Sr No.	Name of compound	Activity
1	1-Heptadecene	Antibiotic [16]
2	8-Octadecanone	Antimicrobial [16]
3	Hexadecanoic acid, methyl ester	Nematicide, Insecticide, Antifungal, Antibiotic, Flavor, Pesticide, Antioxidant, Hypocholesterolemic, 5- Alpha reductase inhibitor [17,18]
4	Caryophyllene	Anti-inflammatory activity [19]

Table 3: FTIR spectral wavenumber's values and functional groups obtained from the leaves powder of *R. minima* [20]

Sr No.	Wavenumbers	Functional groups
1	607.63	Disulfides (S-S Stretch)
2	772.89	Aliphatic Chlorocompounds (C-Cl Stretch)
3	1034.83	Phosphate ions
4	1231.63	Aromatic Ether, aryl-O Stretch
5	1524.95	Aromatic nitro Compounds
6	1687.00	Open chain amino (-C = N-)
7	1733.11	Ester
8	1781.39	Open chain acid anhydried
9	2317.45	Unknown
10	2364.47	Unknown
11	2850.63	Methylene (-H asym./sym-Stretch)
12	2912.65	Alkanes (CH)
13	3280.58	Normal Polymeric OH Stretch
14	3557.44	Internally bonded OH Stretch
15	3615.65	Tertiary Alcohol , OH Stretch
16	3680.01	OH -Stretch acidic
17	3740.40	Unknown
18	3851.81	Unknown

gold nanoparticles, and these compounds may also serve as reducing and capping agents [23,24] Preliminary phytochemical screening of the *R. minima* aqueous leaf extract revealed the presence of alkaloids, flavonoids, tannins, terpenoids and glycosides [25].

CONCLUSIONS

In the current evaluation, a study of Gas Chromatogram-Mass spectrometry (GC-MS) has identified nineteen bioactive compounds from the methanolic leaf extract of *R. minima*. The presence of various bioactive compounds in *R. minima* has shown that the pharmaceutical significance. FTIR analysis of *R. minima* leaves shows lipid, protein, phosphate ions, carboxylic acid, hydroxy compound, aliphatic bromo compound (Figure 2 and Table 3) [20]. *Rhynchosia* is an economically important genus that is distributed all over the world. Phytochemical investigations into many species of *Rhynchosia* have shown that the genus is limited to the abundance of C-glycosylflavonoids developing. The *Rhynchosia*'s preliminary phytochemical screening revealed alkaloids, flavonoids, tannins, terpenoids, and glycosides. Wild legume *Rhynchosia* is a rich source of phytochemicals and nutrition and provides possibilities for advancement as a stand-by for cultivated species as a vegetable. The several species of *Rhynchosia* exhibit antioxidant, antimicrobial, anti-nutritional, antifungal, antidiabetic, anti-inflammatory and anticancer activities that suggest they have a

range of medicinal properties as well as exceptional nutritional potential.

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