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Striga Hermonthica (Del.) Benth Extracts: Phytochemistry Antioxidant and Antibacterial Activity By GC- Ms. Analysis

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Abstract

Bioactive substances found in medicinal plants are utilized to treat various human ailments. Benefits of the witchweed parasite Striga hermonthica (Del.) Benth. is the primary cause of the threat to food security in north Darfur, Sudan; it also has a positive side in the variety of traditional therapeutic uses. The objective of this study's mini-review is to screen for phytochemical profiles and analyze the antioxidant and antibacterial properties of powder extracts of Striga hermonthica. The crude extracts were made using the maceration technique and methanol and chloroform1:1) to use GC-MS to determine the composition of Striga hermonthica. Because Striga hermonthica contains both saturated and unsaturated fatty acids, the bio-guided tests of the extracts revealed significant antioxidant activities and improved antibacterial activity to advance gradually at concentration. GC-MS analysis of powder extracts revered the presence of antioxidant and antibacterial components.

Keywords: *Striga hermonthica*, traditional medicinal, antioxidant, antibacterial

Full-length article **Corresponding author's* e-mail: AR.Mohamed@qu.edu.sa

1. Introduction

Only after extensive testing of chemicals and pharmaceuticals did modern medicine develop from folk medicine and the conventional system. Modern microbiological and chemical techniques can create therapeutic and aromatic chemicals, but doing so is frequently expensive, therefore plants continue to be the main source of these substances [1]. According to folklore knowledge, medicinal plants are those that provide therapeutic benefits. The local populations use them to treat a variety of illnesses [2]. The success of plant-based medications in clinical settings has renewed interest in studying medicinal plants as possible sources of novel medications. In some nations, such as China and India, the study of medicinal plants has reached a mature stage, and plant-based treatments are now used as complementary or alternative therapies to modern pharmaceuticals.

The therapeutic potentials of these natural resources were not fully utilized since, in the majority of African countries, the study of medicinal plants has not received the appropriate amount of attention [3]. A crucial component of the people's ethnobotanical characteristics has been the use of medicinal plants. Asthma, catarrh, chronic bronchitis, cough, hay fever, hemoptysis, pneumonia, pulmonary disorders, and tuberculosis are just a few of the respiratory illnesses that many plant species that are extensively spread in Sudan are used to treat in traditional medicine, in addition to other human illnesses. 20,000 plant species are said to be used for therapeutic reasons [5]. It was noted that 119 plant-derived medications were studied chemically to identify the active ingredients that underlie their traditional uses and that 74% of these pharmaceuticals were eventually discovered.

Despite the widespread usage of S. hermonthica as a medicinal plant and the research into the significance of this plant for agriculture, comprehensive knowledge of phytochemistry is still lacking [6]. In fact, phytochemicals in medicinal plants combine with nutrients in vegetables, fruits, and nuts to potentially slow the aging process, lower the risk of developing, or even eliminate, several diseases, including cancer, diabetes, high blood pressure, cataracts, tuberculosis, and urinary tract infections. Inhibitory efficacy against tiny pathogens like bacteria, fungi, and viruses was seen in numerous plant extractives [7,8]. S. hermonthica has also yielded the monoterpene alkaloid venoterpin, which is produced from iridoids [9]. Additionally, S. hermonthica has been utilized in numerous research to cure leprosy and leprous sores. A decoction or infusion of the roots is taken internally in East Africa as an abortifacient and to cure pneumonia [10]. The petroleum ether extracts of Striga desiflora Benth and S. orobachioredes, for example, have been approved for their pharmacological properties, as shown in Table 2 Benth demonstrated actions against both pathogenic and nonpathogenic microorganisms [11].

Additionally, S. sulphurea's ethanolic extract has been shown to have antibacterial effects on S. aureus, E. coli, Pseudomonas aeruginosa, and Aspergillus niger [12]. All of these might essentially support the extensive historical applications of the genus Striga as pharmacological treatments for numerous ailments. Numerous lethal infectious diseases, including leprosy and tuberculosis, were brought on by these bacteria. Folklore medicine employed some medicinal plants to treat respiratory conditions, including tuberculosis symptoms. These plants may contain bioactive chemicals that are the cause of the therapeutic potentials that have been identified. [13]. Striga hermonthica is a herbaceous annual plant that grows to a height of 30 to 100 cm. The Sudan and Ethiopia are home to the strongest varieties. Bigger plants could have a lot of branches. The plant has a rough texture due to the unique trichomes covering the stems and leaves. The flower is asymmetrically campanulate, the tube is 1-2 cm long, bending around halfway up in West African, Sudanese, and Ethiopian populations but typically far over halfway in East African populations [14]. On the lower half of the stem, the leaves are mostly opposite; however, they are irregular and narrowly lanceolate above that. The plant's lower nodes produce branches, which ramify and develop secondary haustoria and attachments when they come into contact with other hosts. The weak root system has little to no capacity to absorb nutrients from the soil, and its life cycle is closely related to that of the host plant. Image (1).

The flow of sap across the xylem bridge very probably affects the parasite's capacity to extract nutrients and water from the host [15]. S. hermonthica is a well-known medicinal plant that has a wide range of pharmacological effects against both physiological and viral disorders in both animals and humans. It has been used extensively in African traditional medicine. from the options However, there is currently a dearth of knowledge on phytochemicals and their pharmacologic effects. To fully understand the extensive use of this plant in African traditional medicine, more rigorous investigation is needed. It would be extremely important to use the ovicidal and larvicidal capabilities shown by this plant to perform mosquito management in Africa. The latter is also a location where future research will be conducted for additional evaluations. Recently, we discovered that an aberrant protein phosphatase named as the cause of the atypical stomatal behavior causes loss of sensitivity to abscisic acid.

S. hermonthica (Delile) Benth, a root-parasitic plant, can occasionally be found in certain locations. Rice is a real host for S. hermonthica and grows best in low-fertility environments. It is also connected to some of the most primitive farming practices in Africa, where farmers have few resources and few options for controlling the parasite, which leads to severe yield losses. The therapeutic characteristics of medicinal plants may be attributed to the presence of numerous secondary metabolites, which are phytochemical components found in these plants that make them effective for treating a variety of illnesses. The plants were chosen in accordance with an ethnobotanical study of medicinal herbs used in treating respiratory illnesses and tuberculosis symptoms [16].

The prevalent low soil fertility, erratic rainfall, and low input (subsistence farming) circumstances are anticipated to make S. hermonthica infestation and damage worse [17]. The discovery and screening of phytochemical components that are essential for the creation of novel medications is done using medicinal plants. Due to the existence of the phytochemical elements, the results of the current study and the prior phytochemical examination are remarkably similar. To create novel medications for the treatment of various ailments, pharmaceutical corporations, and research organizations have a commercial interest in the phytochemical analysis of medicinal plants.

2. Materials and Procedures

2.1. Plant Resources

The plant was randomly obtained from a local farmer close to the western University of Al Fashir's "Glow area" and recognized there by the National Herbarium, where a voucher specimen has been stored for future use. The plant components were cleaned with distilled water to get rid of dirt and other impurities before being spread out on a spotless surface to dry in the shade for ten to fifteen days. Using a blender grinder, the dried material was ground into a fine powder and placed in airtight containers for storage. The substance that had been powdered was then utilized to make extracts. phytochemical screening, and GC-MS analysis.

2.2. Preparation of plant extract

Hexane, chloroform, ethyl acetate, and methanol were all consecutively used to extract 150 g of the powdered Striga hermonthica plant in the Soxhlet apparatus. With the help of a rotary evaporator, the produced extracts were dried under decreased pressure, yielding 3.15 g of hexane extract, 2.92 g of chloroform extract, 1.54 g of ethyl acetate extract, and 5.43 g of methanolic extract.

2.2.1. Phytochemical screening

- **Alkaloids Test**

A test tube containing 0.5 g of the powdered sample was filled with 3 mL of ammonia solution, which was then added. After a few minutes, the test tube was agitated with 5 mL of chloroform, which was then filtered to remove the powder samples. Mayer's reagent was then added after the chloroform had been evaporated using a water bath. There was a precipitate that was creamy [18].

2.2.2. Terpenoid and Steroid Test

0.1 g of the aqueous plant extract was treated with 0.5 mL each of acetic anhydride and chloroform. Then slowly add concentrated sulfuric acid. A reddish-violet hue was seen (19).

2.2.3. Flavonoid Test

To 0.5 mL of methanolic extract, a few drops of diluted sodium hydroxide solution were added. When a few drops of diluted H2SO4 acid were added, a vivid yellow color that had previously appeared turned colorless [20].

2.2.4. Phenolic Compounds Test (Ferric chloride test)

In 5 ml of distilled water, 0.5 g of the raw plant extract was diluted and filtered. 5% Ferric chloride was added to the filtrate. It was seen that the color was dark green [21].

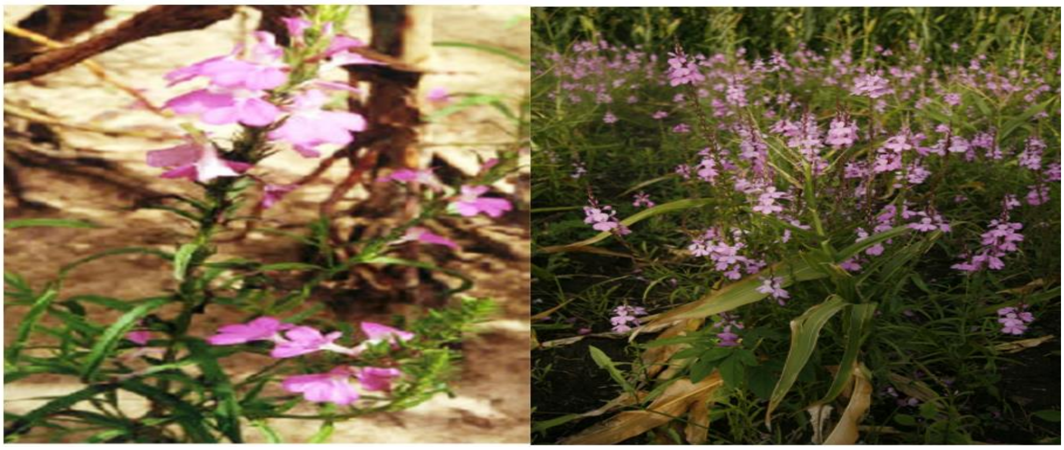


Figure 1: *Striga hermonthica*

2.2.5. Tannins Test

One mL of water, one to two drops of ferric chloride solution, and 0.5 mL of extract solution were added. The color was a deep blue. [22] Using the established techniques, the presence of triterpenes, sterols, tannins, coumarins, cardiac glycosides, flavonoids, saponins, anthrocenosides, carotenoids, glycosides, and alkaloids was evaluated [23, 24].

2.2.6. (GC/MS) Analysis

The Agilent Technologies 7890A GC System, 5975C with Triple-Axis Detector mass spectrometer, and HP-5 capillary column (30 m x 0.32 mm x 0.25 mm) were used for the gas chromatography/mass spectrometry analyses. detection using GC/MS, Ionization energy and an electron ionization mechanism were employed. The column temperature program was the same as previously mentioned, with helium carrier gas flowing at a rate of 1 mL min^{-1} [25].

3. Results and Discussion

3.1. Preliminary screening for phytochemicals

Around 80% of the rural population relies on herbal medicine as their primary form of healthcare, and its efficacy has been proven (WHO, 1978). Medicinal herbs are an efficient source of both traditional and modern medications. One of these species, S. hermonthica, is essential to folk medicine in various regions of Africa. S. hermonthica callus and the entire plant were subjected to phytochemical analysis in order to evaluate the scientific merits of the plant's traditional applications. Alkaloids, flavonoids, coumarins, cardiac glycosides, anthracenosides, saponins, tannins, reducing agents, terpenes, and steroids are some examples of plant compounds. were among the active principal metabolites found during the preliminary screening (Table 1). These findings are somewhat in line with those of researchers who claimed that whole plants included heart glycosides, tannins, flavonoids, volatile oils, and saponins.

This is the first report on coumarins and anthracenosides, in comparison. According to the information gathered during this investigation, flavonoids, terpenes, sterols, and glycosides were present in roughly high concentrations in both S. hermonthica callus and intact plants. (26) calculated that the acetone aqueous extract of S. hermonthica contained about 4% flavonoids, mostly in the form of luteolin.

However, among the examined sections. There were various concentrations of alkaloids, reducing sugar, coumarins, cardiac glycosides, and tannins. discovered (Table 1). All of the examined extracts did not include anthracenosides or models, with the exception of the chloroform extract, which contained traces of anthracenosides. The discovery of the bioactive principles may thus be helped by the early screening tests, which may then encourage the study of novel compounds. By watching the intensity of the test color, which served as an indicator of the amount of phytochemicals, these amount remarks were calculated. These early studies also aid in the following quantitative estimation and qualitative separation of pharmacologically active chemical substances. Plants may have therapeutic properties due to their alkaloids, flavonoids, glycosides, phenols, saponins, sterols, and other secondary metabolites. [27]. S. hermonthica has been widely utilized in traditional treatments for a variety of illnesses, including trypanosomiasis, malaria, and several bacterial infections. The numerous phytochemicals that have been found in this plant may be the cause of the plant's broad-spectrum therapeutic potential [28]. However, there is currently a dearth of scientific data regarding the phytochemical makeup of S. hermonthica and its active components. The scientific use of this plant in treatments still has to be proven, notwithstanding claims about its therapeutic success. No one has attempted to purify the components found in the plant extract, but the plant's crude extract has demonstrated its potency against a variety of ailments. [10,29].

The therapeutic characteristics of medicinal plants may be attributed to the presence of numerous secondary metabolites, which are phytochemical components found in these plants that make them effective for treating a variety of illnesses. The plants were chosen in accordance with an ethnobotanical investigation of medicinal plants used in treating respiratory illnesses and tuberculosis symptoms. GC-MS evaluation of S. hermonthica extracts antioxidant and antibacterial properties were found from powder extracts, which may be related to the chemical profiles as observed in GC-MS Fig. 2. and rich contents of phenolic compounds. Hexane, 2,2 dimethyl 10.06 % Pentane, 1(2propenyloxy) 3.87 %, 3,5Dimethyl 4oxo 4H Pyrazole 1,2 dioxide 10.06 % and 2H Pyran2one, 6 hexyl tetrahydro 3.80 %. *S. hermonthica* Extract has a number of hydroxyl groups that can provide H+ atoms to stabilize free-radical processes.

(Table 1): Phytochemical constituents of *S. hermonthica* extracts

Phytochemical constituents	Inference (extract)			
	Hexane	Chloroform	ethyl acetate	Methanol
Triterpenes/sterols	+	+	+	++
Tannins	+	±	±	+
Coumarins	−	+	+	+
Cardiac glycosides	+	+	±	+
Flavonoids	++	+	++	++
Saponins	++	+	+	±
Anthracenosides	−	±	−	−
Carotenoids	±	−	−	−
Alkaloids	−	+	+	+

++ = reasonable amount, + = moderate amount, ± = trace amount,− = not detected

Table 2: GC-MS determination of *S. hermonthica* extracts

RT	Compound Name	Area %
22.39	Hexane, 2,2dimethyl	10.06
14.18	Pentane,1(2propenyloxy)	3.87
15.21	6,7Bis[(methoxycarbonyl)methyl]1,3,5,8tetramethyl2,4divinylpor phyrin	2.23
11.34	1Ethylcyclopropanol	2.15
16.88	Hydroxylamine,O(2methylpropyl)	1.84
11.63	(5,10,15,20tetraphenyl[2(2)H1]prophyrinato)zinc(II)	2.54
14.18	2HPyran2one, 6hexyltetrahydro	3.80
16.88	Hydroxylamine,O(2methylpropyl)	1.84
15.21	Bis((æ-chloro)[1,2,3ü(3)1[(tertbutyldimethylsilyl)oxy]2butenyl]nicdel(II)]	2.23
11.63	(2,3Dihydro5,10,15,2 0tetraphenyl[2(2)H1] prophyrinato)copper(II)	2.54
16.88	Pentanoic acid, 1,1dimethylpropyl ester	1.84
27.66	N,N'Dicyclohexyl1,7dipyrrolidinylperylene3,4:9,10tetracarboxylic acid bisimide	2.82
22.39	3,5DIMETHYL4OX O4HPYRAZOLE 1,2DIOXIDE	10.06
14.18	2,5[Bis((4,5di(metho xycarbonyl)1,3dithiaol2ylidene) methyl]Nm methyl pyrrole	3.87
26.22	1'''Trimethylsilyl3bromo[1[4(2phenyl1,4d hexyl phenyl) phenyl] benzene	3.65
28.85	(2,2Dibenzyloxy3nit ro5,10,15,20tetraphen yl2,3dihydroporphyrinato)copper(II)	2.69
27.81	Bis[(2,4,6Tritertbutyl phenyl)amino]phenylch lorosilane	1.98
28.85	2[2,6Bis(hex5enoxy)phenyl]9[2,6bis(pen T 4enoxy) phenyl]1,10 phenanthroline	2.69

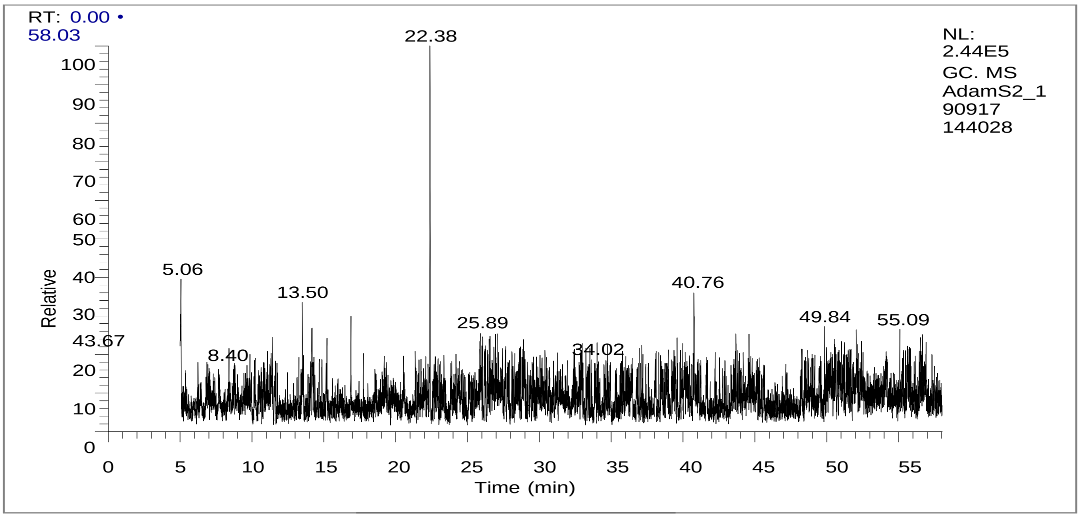
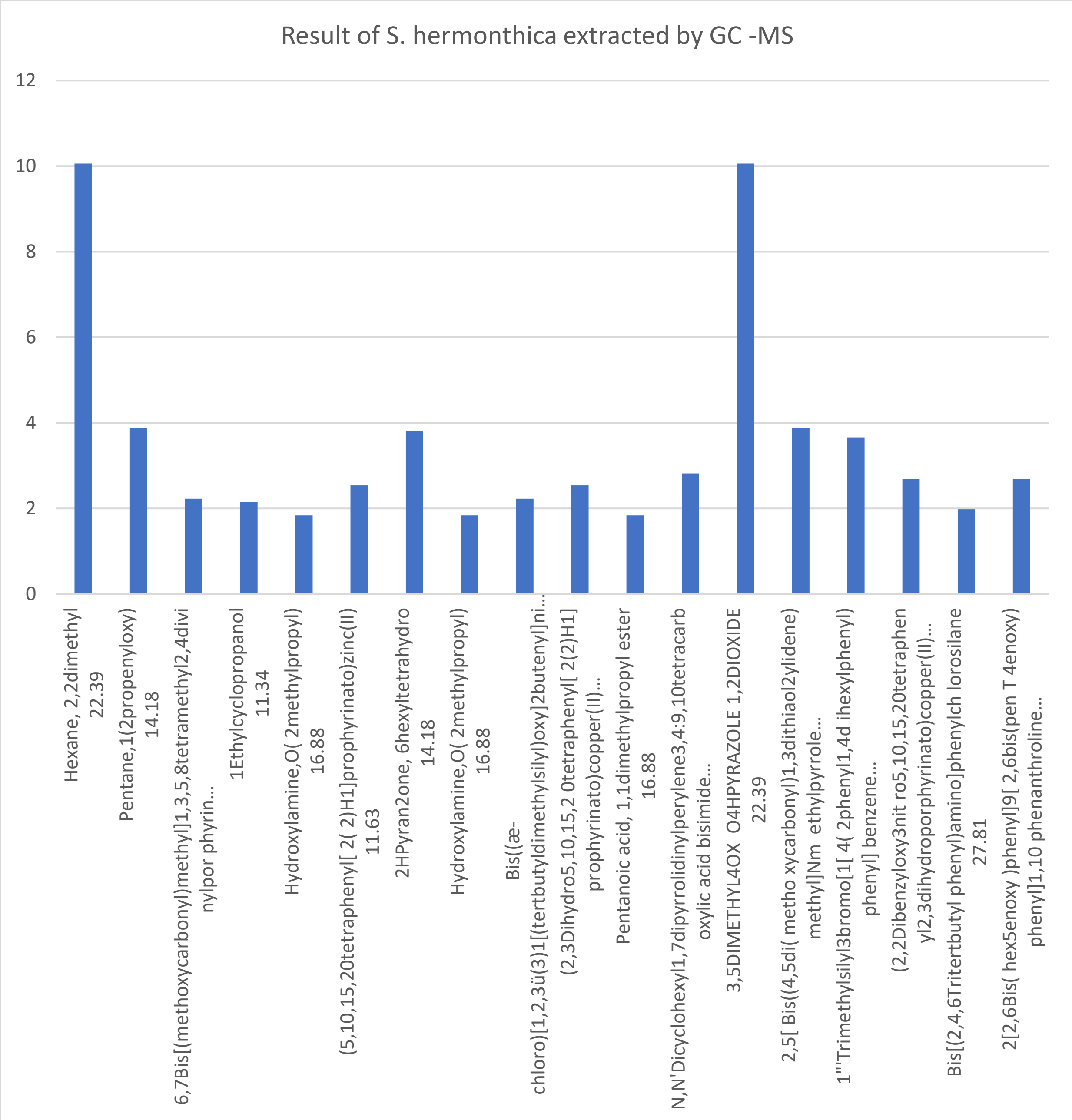
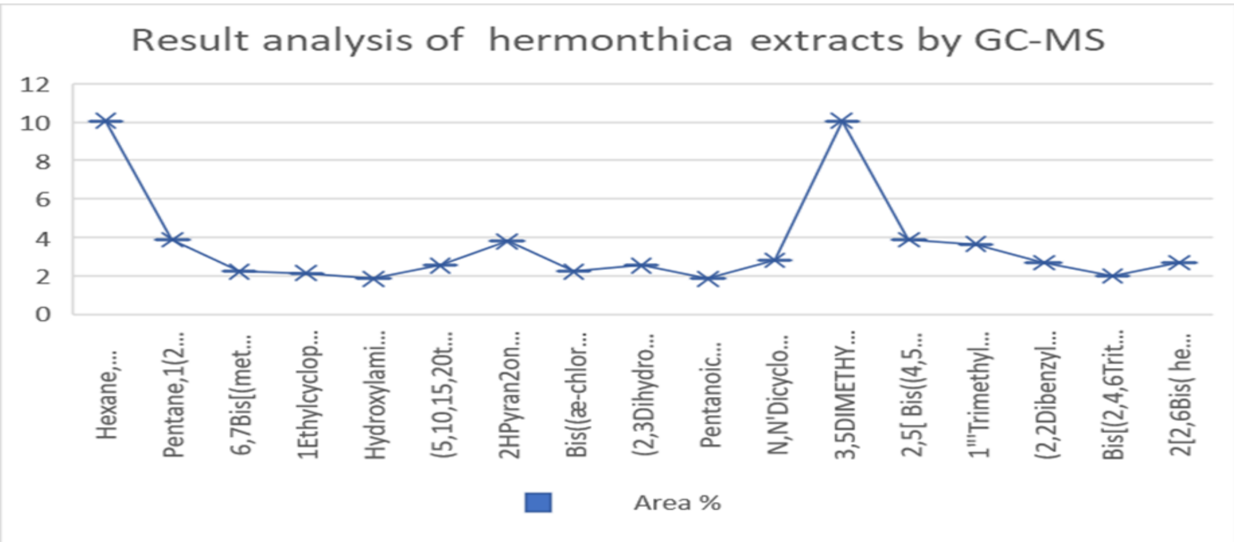


Figure 2. GC-MS of *S. hermonthica* extracts


Result of S. hermonthica extracted by GC -MS
12
10
8
6
4
2
0
Hexane, 2,2dimethyl 22.39
Pentane,1(2propenyloxy) 14.18
6,7Bis[(methoxycarbonyl)methyl]1,3,5,8tetramethyl2,4divi nylpor phyrin...
1Ethylcyclopropanol 11.34
Hydroxylamine,O(2methylpropyl) 16.88
(5,10,15,20tetraphenyl[2(2)H1]prophyrinato)zinc(II) 11.63
2HPyran2one, 6hexyltetrahydro 14.18
Hydroxylamine,O(2methylpropyl) 16.88
Bis((æ-chloro)[1,2,3ü(3)1[(tertbutyldimethylsilyl)oxy]2butenyl]ni...
(2,3Dihydro5,10,15,2 0tetraphenyl[2(2)H1] prophyrinato)copper(II)...
Pentanoic acid, 1,1dimethylpropyl ester 16.88
N,N'Dicyclohexyl1,7dipyrrolidinylperylene3,4:9,10tetracarb oxylic acid bisimide...
3,5DIMETHYL4OX O4HPYRAZOLE 1,2DIOXIDE 22.39
2,5[Bis((4,5di(metho xycarbonyl)1,3dithiaol2ylidene) methyl]Nm ethylpyrrole...
1'''Trimethylsilyl3bromo[1[4(2phenyl1,4d ihexylphenyl) phenyl] benzene...
(2,2Dibenzyloxy3nit ro5,10,15,20tetraphen yl2,3dihydroporphyrinato)copper(II)...
Bis[(2,4,6Tritertbutyl phenyl)amino]phenylch lorosilane 27.81
2[2,6Bis(hex5enoxy)phenyl]9[2,6bis(pen T 4enoxy) phenyl]1,10 phenanthroline...


Result analysis of hermonthica extracts by GC-MS
12
10
8
6
4
2
0
Hexane,...
Pentane,1(2...
6,7Bis[(met...
1Ethylcyclop...
Hydroxylami...
(5,10,15,20t...
2HPyran2on...
Bis((æ-chlor...
(2,3Dihydro...
Pentanoic...
N,N'Dicyclo...
3,5DIMETHY...
2,5[Bis((4,5...
1'''Trimethyl...
(2,2Dibenzyl...
Bis[(2,4,6Trit...
2[2,6Bis(he...
Area %

4. Conclusion

The investigation of the anti-inflammatory and antimicrobial properties of Striga hermonthica's herbal extract Striga hermonthica's antioxidant and antibacterial properties were revealed by the phytochemical study to be caused by the presence of substances such alkaloids, terpenes, steroids, flavonoids, triterpenes, phenolic compounds, and tannins. The findings also suggested that research on medicinal plants with historical claims to efficacy might provide positive outcomes. These plants may be a valuable source of fresh antibacterial substances.

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