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# Chemical Constituents Analysis of the Leaves of *Bryophyllum pinnatum* by GC-MS

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**Abstract**

Chemical constituents by GC/MS analysis of an important medicinal plant, *Bryophyllum pinnatum* was studied. Despite its rich pharmacological potential, so far the chemical constituents of the Leaves have not been fully documented. Hence in this study, the phytochemicals from the *Bryophyllum pinnatum* leaves were extracted with ethanol and subjected to GC/MS analysis. Identification of compounds was done by comparing the chromatogram, peak value of the unknown compound with entries in NIST database. Among the 9 phytochemicals identified, oleic acid constituted the highest percent 26.60%, followed by alpha-D-Glucopyranoside, methyl, 24.83%. Other compounds include n-Hexadecanoic acid, 17.83%, Octadecanoic acid, 14.45%, 3,5-Dihydroxy-6-methyl-2,3-dihydro-4H-pyran-4-one, 6.19%, Benzaldehyde, etc. Oleic acid is used as emollients, small amount of oleic acid is used as an excipient in pharmacy, and consumption of oleate in olive oil has been associated with a decreased risk of breast cancer and reduction of blood pressure. 3,5-Dihydroxy-6-methyl-2,3-dihydro-4H-pyran-4-one has already been reported to possess anticancer activity. Brief analysis of some of the compounds reveals the rich pharmacological potential of this part of the plant and thus justify the use of the Leaves of this plant in the treatment of various diseases.

**1. Introduction**

*Bryophyllum pinnatum* also known as life plant, or Maternity plant, is a perennial herb growing widely and used in folkloric medicine in tropical Africa, tropical America, India, China and Australia. The plant flourishes throughout the southern part of Nigeria [1]. It is well known for wound healing properties. It also has considerable attention for their medicinal properties and folk medicine, as well as in the contemporary medicine. *Bryophyllum pinnatum* has many phytochemicals which includes flavonoids, saponins, tannis and alkaloids [2]. Vitamins including ascorbic acid, riboflavin, thiamine, niacin and minerals such as calcium, zinc and phosphorus are also present in the leaves [3].

The leaves have been reported to possess a variety of medicinal properties including antimicrobial [4], antifungal, antiulcer, antihypertensive [5], antidiabetic, anti-inflammatory, analgesic and wound healing [6]. Reports also show that the leaves possess anti-tumour [7], it has sedative and muscle relaxant effect [8]. It may also be effective in treatment of leishmaniasis [9]. Herbal practitioners in Nigeria and other parts of Africa use the aqueous extract for the treatment of coughs and as a prophylactic

medicine for asthma. In Benin city, Nigeria, the leaves are boiled filtered through a clean white cloth and the yield reconstituted for daily oral use by asthmatic patients. The leaves and bark are bitter tonic, astringent to the bowels, analgesic, carminative, useful in diarrhea and vomiting. It is applied externally and taken internally for all types of pains and inflammations, various bacterial, viral and fungal infections, leishmaniasis, earaches, upper respiratory infections, stomach ulcers, flu and fever [10]. The herb is used to facilitate the dropping of the placenta of newly born baby. Leaf juice is used in the treatment of coughs, bronchial affections, blood dysentery, jaundice and gout. It is applied externally and taken internally for all types of pains and inflammations, various bacterial, viral and fungal infections, flu and fever [7]. The plant is commonly called a master herb or cure for all antimalarial effect by a large community of herbal practitioners [11].

*B. Pinnatum* is rich in alkaloids, triterpenes, glycosides, flavonoids, cardenolides, steroids, bufadienolides and lipids. The leaves contain a group of chemicals called bufadienolides which are very active and possesses antibacterial, antitumor, cancer preventative and insecticidal actions [10].

Juice from the fresh leaves is used for the treatment of jaundice in India because it was found to be effective as evidenced by *in vivo* and *in vitro* histopathological studies for hepatoprotective activity of plant and justifies the use of the juice of the leaves in folk medicine for jaundice [12]. The plant has potent antihistamine and anti-allergic activity. According to [4] in a study, found that 60% methanolic leaf extracts inhibits the growth of five out of eight bacteria used at a concentration of 25mg/ml, *Bacillus subtilis*, *E. coli*, *Proteus vulgaris*, *Shigella dysenteriae*, *S. aureus* were found to be inhibited while *Klebsiella pneumoniae*, *P. aeruginosa* and *C. albicans* were found to resist the action of the extract.

In spite of the various uses of *Bryophyllum pinnatum*, the chemical constituents of the plant have not been fully documented hence this study.

## 2. Materials and Method

### 2.1. Plant Material: Sample Collection/Preparation

The leaves of *Bryophyllum pinnatum* were collected from biological garden in Alvan Ikoku Federal College of Education, Imo State Nigeria. The leaves were identified by a Taxonomist Dr. Nwachukwu in the Department of Biology of Alvan Ikoku Federal College of Education Nigeria. The fresh leaves were destalked and washed, allowed to dry in a laboratory bench for some days. The leaves were ground and soaked in ethanol for 48hrs and 5ml of the solvent was used for the analysis.

### 2.2. Experimental Procedure for Gas Chromatography - Mass Spectrometry (GC-MS) Evaluation of the Plant

Gas- chromatography analysis was performed using GC-MS SHIMADZU QP – 2010, JADAN gas chromatography 5890 – 11 with a fused GC column (0.25m x 50m) coated with polymethyl silicon (0.25m x 50m) and the conditions were as follows; temperature programming from 80 – 200°C held at 80°C for 1 minute, rate 5°C /min and at 200°C for 20 mins F/D temperature 300°C injection temperature 250°C, carrier gas nitrogen at a flow of 1ml/min split ratio 1:75. The column length was 30m with a diameter of 0.25m and the flow rate of 50ml/min the elutes were automatically passed into a mass spectrometer with a detector voltage set at 1.5kv and sampling ratio of 0.2sec. The mass spectrum was also equipped with a computer fed mass spectra data bank. HERMLEZ 233 M-Z centrifuge Germany was used. Reagent and solvent like ethanol, chloroform, diethyl ether, hexane were all analytical grade and were procured from Merck, Germany.

Component Identification: To identify the unknown phytochemical components present in the ethanol extract, their individual mass spectral peak value was compared with the database of National Institute of Science and Technology. Then the phytochemicals were identified after comparing the unknown peak value and chromatogram from GC-MS against the known chromatogram, peak value from the NIST Library database. Subsequently, the details about their molecular formula, molecular weight, retention time and percentage content were also obtained. [13].

## 3. Results and Discussions

The ethanol extract of the leaves of *Bryophyllum pinnatum* on GC-MS analysis showed nine peaks indicating the presence of nine compounds in the plant as shown in figure. 1. The molecular formula, the molecular weight, the retention time and the percentage constituents of the compounds are shown in Table 1.

The first compound is Butyrolactose with molecular formula  $C_4H_6O_2$  (m/z86). The base peak occurred at m/z 42 due to the detachment of  $C_2H_2O$  fragment. It constitutes 1.06 % of the oil. The second compound is 3,4-Epoxytetrahydrothiophene -1,1-dioxide with the molecular formula  $C_4H_6O_3S$  (m/z 134). The percentage constituent is 1.63%. The third compound is 1-octen-3-ol. The molecular formula is  $C_8H_{16}O$  (m/z56.95). The percentage constituent is 2.86%. The fourth compound is 3, 5-Dihydroxy-6-methyl-2, 3-dihydro-4H-pyran-4-one with the molecular formula  $C_6H_8O_4$  and it constitutes 6.19% of the extract. Peak at (m/z 57) is as a result of detachment of  $C_2HO_2$  from the compound. The fifth compound is Benzaldehyde, 2-methyl with the molecular formula  $C_8H_8O$  and it constitutes 4.98% of the extract. The base peak of this compound is m/z 91.10. The sixth compound is alpha-D Glucopyranoside, methyl

with the molecular formula  $C_7H_{14}O_6$  and it constitutes 24.83% of the extract. The base peak of this compound is  $m/z$  60. The seventh compound is n-hexadecanoic acid with the molecular formula  $C_{16}H_{32}O_2$  and it constitute 17.38% of the extract. The base peak of this compound is  $m/z$  43. The eighth compound is oleic acid with the molecular formula  $C_{18}H_{34}O_2$  and it constitute the highest percent 26.62% of the extract. The base peak of this compound is  $m/z$  55. The ninth compound is octadecanoic acid with the molecular formula  $C_{18}H_{36}O_2$  and it constitute 14.45% of the extract. The base peak of this compound is  $m/z$  41.00.

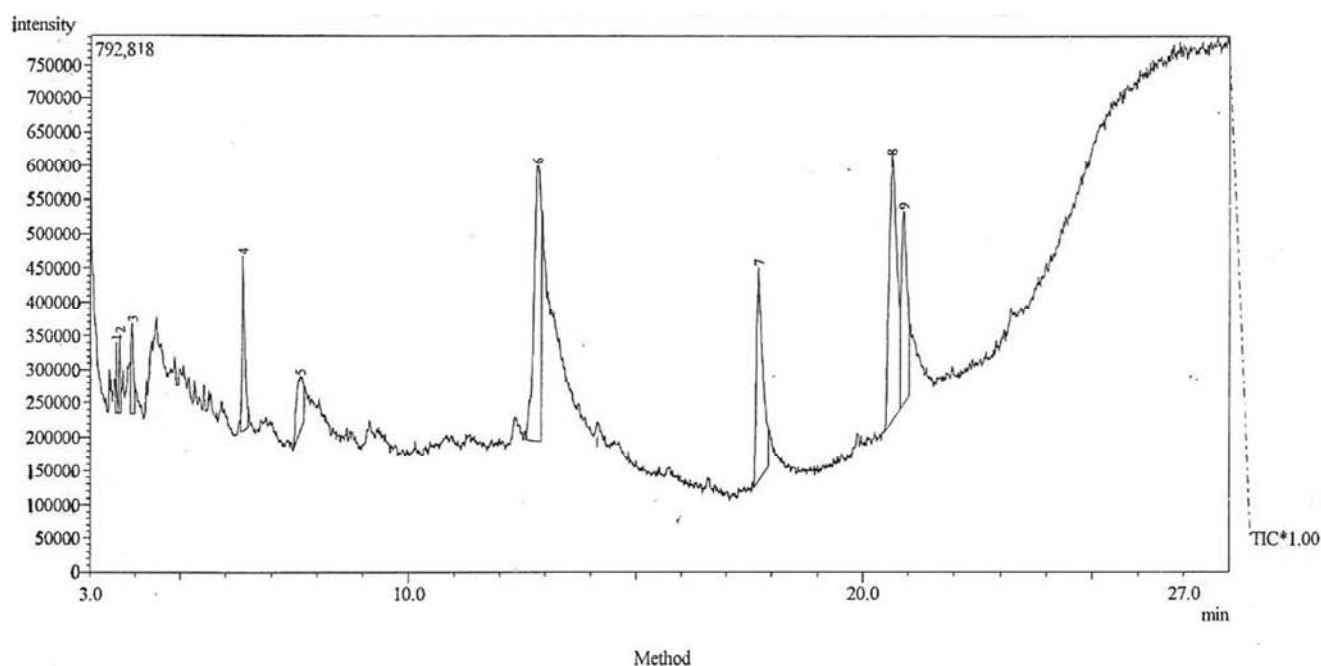
The leaves of *Bryophyllum pinnatum* were found to contain oleic acid. Oleic acid is used as emollients, small

amount of oleic acid is used as an excipient in pharmacy, and consumption of oleate in olive oil has been associated with a decreased risk of breast cancer and reduction of blood pressure [14]; [15].

n-Hexadecanoic acid was also found to be present in *Bryophyllum pinnatum*, in India, medicated oils rich in n-Hexadecanoic acid are used in the treatment of rheumatism and inflammation [16]; [15]. 3, 5-Dihydroxy-6-methyl-2, 3-dihydro-4H-pyran-4-one found in the oil has been reported to possess anticancer activity. Alpha-d-glucopyranoside also found in the plant has been reported to have anti tuberculosis activity, antioxidant activity, alpha amylase inhibitory activity and anticonvulsant [17].

**Table 1.** The list of phytochemicals identified with respect to the chromatogram (figure 1) obtained from GC – MS analysis of ethanol extract of the leave of *Bryophyllum pinnatum*.

Peak#	Compound	Molecular Formula	Molecular Weight	Retention Time	% Content
1	Butyrolactone	$C_4H_6O_2$	86	3.575	1.06
2	3, 4 –Epoxytetrahydrothiophene-1,1-dioxide	$C_4H_6O_3S$	134	3.651	1.63
3	1-Octen-3-ol	$C_8H_{16}O$	128	3.924	2.86
4	3,5-Dihydroxy-6-methyl-2,3-dihydro-4H-pyran-4-one	$C_6H_8O_4$	144	6.370	6.19
5	Benzaldehyde,	$C_8H_8O$	120	7.639	4.98
6	alpha-D-Glucopyranoside, methyl	$C_7H_{14}O$	194	12.821	24.83
7	n-Hexadecanoic acid	$C_{16}H_{32}O_2$	256	17.700	17.38
8	Oleic acid	$C_{18}H_{34}O_2$	282	20.633	26.62
9	Octadecanoic acid	$C_{18}H_{36}O_2$	284	20.882	14.45



**Figure 1.** Chromatogram of leaves of *Bryophyllum pinnatum*.

## 4. Conclusion

The leaves extract of *Bryophyllum pinnatum* contain some pharmacologically relevant compounds which were identified in the extract. Among all, the presence of a potent anticancer agent, 5-Dihydroxy-6-methyl-2, 3-dihydro-4H-pyran-4-one (DDMP) and the presence of Alpha-d-glucopyranoside which has been reported to have anti tuberculosis, antioxidant, alpha amylase inhibitory activity

and anticonvulsant in the extract studied is an interesting finding. The presence of these compounds and other compounds found in the leaves extract justified the use of this plant in the treatment of different ailments by the herbalists. Though 9 different compounds have been identified, it may have many more unidentified compounds in the same extract which can be isolated by adopting different extraction procedures. The plant needs further scientific experiments to unveil some of the novel

pharmacophores which might exist in this plant.

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