VOL. 05 NO. 9,
AUGUST, 2024
E-ISSN 3026-958X
P-ISSN 3027-1169

African Scholar Publications & Research International
www.africanscholarpub.com

Journal of Science Innovation & Technology Research (JSITR)

Phytochemical Screening and Elemental Analysis of Detarium Microcapum Stem Bark

Gambo, M. S.,[1] Ahmad, A. I.,[2] and Mohammed A[3],

[1]Department of Science Laborotory Technology, College Of Agriculture Ganye, Adamawa State. [2] Federal College of Education Yola, Adamawa State. [3]Government Senior Secondary School Akkoyel Kumo, Gombe State.
Corresponding Author: *snsgambo@gmail.com*

Abstract

Numerous studies have shown that medicinal plants are source of diverse nutrient and non-nutrient molecules since thousands of centuries, scientific exeperiment have proven the use of plants for medicine and other purpose. The phytochemical constituent and elemental analysis of the aqueous extracts of Detarium microcapum stem bark were investigated through the use of cold extraction method for the preparation of extract, phytochemical screening described by Trease and Evans, finally spectrophotometer was used for the elemental analysis. Qualitative phytochemical analysis indicated that the aqueous extract of the stembark shows: Tannins carbohydrates, terpenoids, cardiac glycosides, saponins are all present. The elemental analysis of the extract of Detarium microcarpum analyzed were Iron, Sulphate, potassium silica (high), nitrite, dissolved oxygen, phosphate, nitrate ammonia nitrogen. This result indicate that Detarium microcapum can serve as an alternative medicine for the cure of some disease as claimed by the traditional medical practitioners and contains biocomponent whose antifungal and antibacterial activities against test organism can be exploited for pharmaceutical use.

Key Words: Detarium Microcapum, Stem Bark, Extract, Phytochemical, Screening, Elemental and Analysis

Introduction

Numerous studies have shown that medicinal plants are source of diverse nutrient and non-nutrient molecules since thousand of centuries. Scientific exeperiment have proven the use of plants for medicine and other purpose (Saratale *et al.,* 2018). Medicinal plants are a valuable source of a wide variety of chemical molecules having different structures and functionalities that exhibit important biological activities and are

linked to a multitude of beneficial properties, such as antimicrobial, anticancer, antiviral, antioxidant and enzyme inhibitory, anti-aging, anti-inflammatory, antihypertensive, neuroprotective and anticoagulant effects (Ali *et al.,* 2019; Lesellier *et al.,* 2021).

Detarium microcapum is a member of the Caesalpinaceae sub-family of leguminosae family of flowering plants (Teddy *et al.,* 2013). It is an uncultivated palnt which thrives in both the rain forest and the Savana Zone in Nigeria. It is a large tree with twisted trunk and a widely spread crooked branches. The fruits are drupe-like circular and disc shape with layer of greenist pulp that have a tangular network of fibers. The seed occur single and are embeded within the hard disc-shape, brownish fruits. Aged seed of *Detarium microcapum* are highly price in the Eastern part of Nigerian because they are used as soap thickner often been processed into flour.The effectiveness of the seed flour as a soap thickner is probably connected to its physiochemical and functional properties. Presently, there is no readily available documented report on the proximate composition of the seed. Proper documentation of its chemical and functional properties could lead to extension of its utilization in other areas of food preparation and formulation.

The natural forest of West and Central Africa are rich in natural resources and have tremendous biodiversity particularly in trees that provide food, fuel, fibre and medicine. Drug drive from plants forms the mainstay of medicinal treatment in the developing countries (Anand *et al.,* 2007). In fact green plant, it has been noted, appear to be reservorist of effective chemotherapeutants and would constitute inexhaustible sources of drugs with numerous actvities. The German Apothecary Frederick W. A. Sertumer in 1806 isolated a white crystaline substance morphine from opium. The first isolation of an active principle of a medicinal plant stimulated so much enthusistive research on the vegetable drugs that mayendic was able to publish a medicinal formulary in (1821) which contain only pure chemical agents. *Detarium microcapum* is vastly use in Nigeria for its medicinal properties and other uses. Plant have been use in herbal remedies providing a still expanding alternative system of medicine infact according to the June issues of "World Health" it has been estimated that more than one – half of the developing countries rely mainly on traditional remedies. So plant have being use since as early as man for medicinal purpose.

The aim of this study is to carry out the aqueous extration of the Stem Bark of *Detarium microcapum* and the objectives of this study is to carry out phytochemical screening and elemental Analysis

MATERIALS AND METHODS

GLASSWARES AND EQUIPMENTS

Test tubes, conical flask, water bath, measuring cylinder, beaker, funnels, filter paper, electrical balance, hot plat.

CHEMICALS AND REAGENTS

Molish reagent, distilled water, sulphuric acid (H_2SO_4), HCl, chloroform, dilute ammonia, Aluminum solution, ethyl acetate, ferric chloride, acid alcohol, citric acid, mayer's reagent, dragendroffs reagent, glacial acitic acid, olive oil, glacial acetic acid, hot plate, electronic balance.

COLLECTION OF PLANT MATERIAL

The Stem bark of *Detarium microcarpum* was obtained in Adamawa State of Ngurore, Yola South in the month of October. The stem bark was identified by the Chief Taxonomist at the Department of Botany, University of Maiduguri. It was then shade dried and milled to powder which was stored in a labeled bottle.

PREPARATION OF CRUDE AQUEOUS EXTRACT

The cold extraction method described by Sofowora, (1994) was used. 100g of sample and 100ml of distilled water was shaken very well in a 500mL conical flask and allowed to stand for 24hrs. After 24hrs the sample was filtered. The extract was obtained after evaporation at a low temperature. The extract obtained was weighed using an electronic beam balance.

PRELIMINARY QUALITATIVE PHYTOCHEMICAL SCREENING

The basic phytochemical screening was carried out using standard procedures described by Trease and Evans, (2002):

TEST FOR REDUCING SUGARS (FEHLING TEST)

The aqueous ethanol extract (0.5g in 5ml of water) was added to boiling Fehlings solution (A and B) in a test tube. The solution was observed for a colour reaction.

TEST FOR ANTHRAQUINONES

0.5g of extract was boiled with 10ml of sulphuric acid (H_2SO_4) and filtered while hot. The filtrate was shaken with 5ml of chloroform. The chloroform layer was pipette into another test tube and 1ml of dilute ammonia was added. The resulting solution was observed for colour changes.

TEST FOR TERPENOIDS

To 0.5g of the extract was added 2ml of chloroform. Concentrated (H_2S0_4) 3ml was carefully added to form a layer. A reddish brown colouration of the interfere indicate the presence of terpenoids.

TEST FOR ALKANOIDS

0.5g of extract was diluted to 10ml with acid alcohol, boiled and filtered. To 5ml of the filtrate was added 2ml of dilute ammonia. 5ml of chloroform was added and shaken gently to extract the alkaloidal base. The chloroform layer was extracted with 10ml of acetic acid. This was divided into two portion. Maryers reagent was added to one portion and Dreggendurffs reagent to the other. The formation of cream (with mayer's reagent) or reddish brown precipitate (with Draggendorff's reagent) was regarded as positive for the presence of alkaloids.

TEST FOR CARDIAC GLYCOSIDES

To 0.5g of extract diluted`1 to 5ml in water was added 2ml of glacial acetic acid containing a drops of ferric chloride solution. This was underlayed with 1ml of concentrated sulphuric acid. A brown ring at the interference indicates the presence of a deoxysugar characteristics of cardenolides. A violent ring may appear below the brown ring, while in the acetic acid layer a greenish ring may from just above the brown ring and gradually spread throughout this layer.

TEST FOR CARBOHYDRATE
A few drops of molish reagent will be added to each of the extract dissolved in.

TEST FOR FLAVONOIDS
Three method were used for flavonoids. First, dilution ammonia (5ml) was added to a portion of an aqueous filtrate of the extract concentration sulphuric acid (1ml) was added. A yellow colouration that disappear on standing indicate the presence of flavonoids. Second a few drops of 1% aluminum solution were added to a portion of the filtrate. A yellow colouration indicates the presence of flavonoid. Third, a portion of the extract was heated with 10ml of ethyl acetate over a steam bath for 3mm. The mixture was filtered and 4ml of the filtrate was shaken with 1ml of dilute ammonia solution. A yellow colouration indication the presence of flanovoid.

TEST FOR TANNINS
About 0.5g of extract was boiled in 10ml of water in a test tube and then filtered. A few drops of 0.1% ferric chloride was added and absorbed for brownish green or a blue-black colouration.

TEST FOR SAPONINS
0.5g of extract was added to 5ml of distilled water in a test tube. The solution was shaken vigorously and absorbed or a stable persistent froth. The frothing was mixed with 3 drops of olive oil and shaken vigorously after which it was observed for the formation of emulsion.

TEST FOR PHLOBATANNINS
A small amount of each extract will be bind with distilled water and then filtered the further boil with 1% of HCL. The apparatus of the raw ppt shows the presence phlobatannins.

ELEMENTAL ANALYSIS
The elements present in the extract of *Detarium microcarpum* was analyzed using smart spectro (spectrophotometer) in National Agency for Food, drug Administration and Control (NAFDAC) Maiduguri, Borno State. The sample was ashed using ashing machine (Cullow Furnance) from the food laboratory. The element analyzed were Iron, Sulphate, potassium silica (high), nitrate, dissolved oxygen, phosphate, nitrite and Ammonia nitrogen.

PROCEDURE
How to use the Smart Spectro

1. Press and hold ON button until spectrophotometer turns ON
2. Scroll to and select programme TEST from menu
3. Scroll to the SELECT ALL TEST from testing menu
4. Rinse a clean tube with sample water. Fill to the 10ml line with sample
5. Insert tube into the chamber, close lid and select SCAN BLANK
6. Each element is been label and stored in the machine e.g Magnesium is label 56.
7. After the blank is set then a sample should be inserted

A. AMMONIA NITROGEN (NH_3)

1. Insert tube chambers, close the lid and select scan blank
2. Remove the tube from the spectro. Use the 1.0 plastic pipette to all 2.0ml salicylate ammonia. Cap and mix.

3. Use the 0.15g spoon to add two measure of salicylate reagent. Cap and mix until it dissolve wait a minute.
4. At the end of the 1 minute waiting period use 1.0g spoon to add two measure of salicylate reagent powder. Cap and shake vigorously for at least 30 seconds and the solid has dissolved by then. Wait 12 minutes for maximum colour development. At the end of 12 minutes waiting period mix, insert tube into chamber. Close the lid and select scan sample. Record the result.

B. PHOSPHATE (PO_4)
1. Insert the tube into the chamber, close the lid and select SCAN BLANK.
2. Remove the tube from the spectrometer. Use 1.0ml pipette to add 1.0ml of phosphate acid reagent. Cap and mix
3. Use the 0.1g spoon to add on measure of phosphate reducing agent. Cape and shake until powder dissolve wait for 5 minutes for full colour development. Solution will turn blue if phosphate are present
4. At the end of 5minutes waiting period mix, insert tube into chamber, close the lid and select SCAN SAMPLE. Record the result.

C. POTASSIUM (P)
1) Insert the tube into chamber, close the lid and select SCAN BLANK.
2) 2. Remove tube from spectro. Add 4 drops of sodium hydroxide 1.0N. Cap and mix.
3) Use the the 0.05g spoon to add one measure of tetraphenylboron powder. Cap and shake vigorously until all the powder is then dissolved. Wait for 5 minutes
4) At the end of the waiting periods mix the tube again and suspend any settled precipitate. Immediately insert the tube into chamber, close the lid and. Select scan sample. Record the result.

D. NITRATE (NO_3)
1. Insert the tube into chamber, close the lid and select SCAN BLANK.
2. Remove the tube from spectro. Add one nitrate spectrophotometric Grade tablet.
3. Use tablet crusher to crush the tablet. Cape the tube
4. Insert tube 10 minutes per minutes for 2 minutes
5. Wait for 5 minutes. Do not mix.
6. Insert tube into chamber, close the lid and SCAN SAMPLE. Record result in ppm nitrate.

E. SILICA (Si)
1. Insert the tube into the chamber, close the lid and select SCAN BLANK.
2. Remove the tube from spectrometer. Add 6 drops of silica reagent. Cap and wit to mix.
3. Add 12 drops of silica reagent. Cap and mix wait for 5 minutes.
4. At the end of 3 minutes waiting periods, add 8 drops of silica reagent. Cap and mix.
5. Insert tube into chamber, close the lid and select SCAN BLANK. Record the result.

F. IRON (Fe_2)
1. Insert the tube into chamber, close the lid and select SCAN BLANK.
2. Remove the tube from the spectro. Use the 0.5ml pipette to add one measure of Iron reagent. Cap and mix.

3. Use the 0.1g spoon to add 0.1g of Iron reagent powder. Cap and shake vigorously for 30 second. Wait 3 minutes for maximum colour development.
4. At the end of 3 minutes waiting periods. Do not mix, insert tube into chamber, close the lid and select SCAN SAMPLE. Record result.

G DISSOLVE OXYGEN (DO)

1. To avoid contamination, thoroughly rinse the screw cap sample tube with sample water.
2. Tightly cap sample tube and sub merge to the desired depth. Remove cap and allow the sample tube to fill.
3. Tab the sides of the submerged tube to dislodge any aim bubble changing inside. Replace the cap while the sample tube is still submerged.
4. Retrieve sample tube and examine it carefully to make some that no aim bubble and tapped inside. Once a satisfactory sample has been collected proceed immediately with the next step. Note: be careful not to introduce the air into the sample which adding reagent. Simply drop the reagent into the sample. Cap carefully and mix gently.
5. Add 2 drops of the Manganese sulphate solution and 2 drops of Alkaline potassium iodide acid. Cap and mix by inserting several time. A precipitate will form. Allow the precipitate to settle below the shoulder of the tube. Before proceeding.
6. Add 8 drops of sulphuric acid. Cap and gently mix until the reagent and the precipitate lime dissolved. A clear yellow to brown. Orange colour will develop depending on the oxygen content of the sample.

   Following the completion of step 6, content between the water sample and then atmospheric will not affect the test result. Once the sample has been fixed in this manner, it is not necessary to perform the actual test procedure. Immediately. Thus several sample can be collected and fixed with field and then carried buck to a testing station or laboratory where the test procedure is to be performed.

RESULTS

The result presented in table 3.1 indicates the weight of total simple, weight of extract used. Weight of total extract, amount of distilled water used. The phytochemical screening of the plant shows the presence of terpenoids, saponins, tannins, carbohydrate, and cardiac glycoside while anthraquinone, reducing sugar, flavonoids, phlobatannin are absent.

Table 1: Percentage yield extract of *Detarium microcapum*

Weight	Aqueous extract
Weight of the sample	**100g**
Weight of total extract	**9.026g**
Weight of extract used	**0.5g**
Amount of distilled water used	**700ml**

Table 2: Phytochemical screening – *Detarium microcapum* stem bark extract.

Phytochemical	Results	Inference
Reducing sugar (fehling	_	**Absent**
Anthraquinones	_	**Absent**
Tapenoids	+	**Present**
Flavonoids	_	**Absent**
Saponin	+	**Present**
Tannins	+	**Present**

Alkaloids	_	**Absent**
Carbohydrate	+	**Present**
Cardiac glycoside	+	**Present**
Phlobatannins	_	**Absent**

KEY: - = Absent
+ = Present

Table 3: Elemental Analysis -*Detarium microcapum* stem bark.

ELEMENT	CONCENTRATION (% ppm)
Iron	**0.05**
Sulphate	**22.0**
Silica	**4.0**
Nitrite	**0.071**
Dissolve Oxygen	**5.5**
Nitrate	**9.0**
Ammonium Nitrogen	**3.5**
Phosphate	**9.0**

The result of Smart spectro analysis of the stem bark of *Detarium microcapum* present in table 3 The element present in the extract are Iron, Sulphate, Silica, Nitrate. Dissolve Oxygen, Nitrite, Ammonia and Phosphate. Sulphide has the highest concentration of 22.0 and Nitrite has the lowest concentration with 0.071%.

DISCUSSION

The result presented in table 1 indicate the weight of total sample 100g and weight of total extract 9.02g. Table 2 shows the results of the phytochemical screening of stem bark of Detarium *microcarpum* contain terpenoids, saponins, carbohydrate, and cardiac glycoside. These class of compound are known to show curative activity against several bacteria.

The presence of tannins in the stem bark of *Detarium microcarpum* revels that the plant have anti-bacterial, anti-inflammatory and anti-parasitic effects. Tannins which are considered polyphenols is to protect the plants from various microorganism. The presence of saponin indicates that the plant have anti-bacteria and anti-viral properties. Saponnins protects the plant from parasite. Saponins are also anti-cancer and protects from heart disease. The presence of carbohydrate in the plant indicates short-term energy storage. Carbohydrate which are organic compound that is composed of atom of carbon, hydrogen and oxygen. The presence of cardiac glycoside stimulate the heart in cases of heart failure, cardiac glycoside which prevent the plant against predators. Presence of terpenoids in the plant help in the growth and development of the plants. The potential of the plant from pathogen and carpitators.

The result in the table 3 shows the elemental analysis which indicated the presence of element such as Iron, Sulphate, Potassium, Silica, Nitrate, Dissolve Oxygen, Ammonia, Nitrogen, Nitrite and Phosphate. Increase in the potassium - nitrogen intake extact remarkable anti-hypertensive effect (Aburto *et al.,* 2013). Potassium regulate the fluid balance of the body and thereby influence cardiac output, the effect is dependent on plasma potassium, which modulates DCT cell membrane voltage and, in turn, intracellular chloride (Andrew *et al.,* 2015).

The element such as Iron are essential because they are important in several enzyme reaction as co-factor (Gretchen and Marinus 2020). Proper extra cellular fluid and periosteal

concentration of phosphate Iron are required for bone mineralization (Marks *et al*., 2010). Ammonia nitrogen is an essential ingredient in the formation of protein for cell growths.

CONCLUSION

This study shows that *Detarium microcarpum* contain active principles and element which are extensively used in health and disease in both humans and animals.

RECOMMENDATION

Further studies on the phytochemcal screening and elemental analysis of *Detarium microcapus* stem bark should contain chemicals and element which are of maximum standard levels. Therefore it can be use medicinally.

REFERENCES

Aburto NJ, Hanson S, Gutierrez H, Hooper L, Elliott P, Cappuccio FP. (2013) Effect of increased potassium intake on cardiovascular risk factors and disease: systematic review and meta-analyses. BMJ 2013; 346:f1378.

Ali M.C., Chen J. , Zhang H. , Li, Z., Zhao L., Qiu H. (2019) Effective extraction of flavonoids from *Lycium barbarum* L. fruits by deep eutectic solvents-based ultrasound-assisted extraction Talanta, 203 (2019), pp. 1622, 10.1016/j.talanta.2019.05.012

Anand P., Kunnumakkara A. B., Newman R. A., Aggarwal B. B. (2007). Bioavailability of curcumin: problems and promises. *Mol. Pharm.* 4 807–818 10.1021/mp700113r

Andrew S.Terker, Chong Zhang, James A. McCormick, Rebecca A. Lazelle, Chengbiao Zhang, Nicholas P. Meermeier, Dominic A. Siler, Hae J. Park, Yi Fu, David M. Cohen, Alan M. Weinstein, Wen-Hui Wang, Chao-Ling Yang, and David H. Ellison (2015) Potassium Modulates Electrolyte Balance and Blood Pressure through Effects on Distal Cell Voltage and Chloride Cell Metab. 2015 Jan 6; 21(1): 39–50. doi: 10.1016/j.cmet.2014.12.006

Evans W.C and Trease (2002).Phamaconocy 15th edition.sauders.london pp214-393.

Federick A. W. Sertürner (1806). The discovery of morphine. 200 years of pain therapy with opioids PMID: **12015680** DOI: 10.1055/s-2002-30132

Gretchen E. K and Marinus P. (2020) Regulation of Iron Homeostasis and Use in Chloroplasts Int J Mol Sci. 2020 May; 21(9): 3395. Published online 2020 May 11. doi: 10.3390/ijms21093395

Lesellier E., Lefebvre T., Destandau E. (2021). Recent developments for the analysis and the extraction of bioactive compounds from Rosmarinus officinalis and medicinal plants of the *Lamiaceae* family. TrAC - Trends Anal. Chem., 135 (2021), Article 116158, 10.1016/j.trac.2020.116158

Marks J, Edward S, Debnam ES, Unwi RJ. Phosphate homeostasis and the renal-gastrointestinal axis. *Am J Physiol Renal Physiol.* 2010;299:F285–F296. doi: 10.1152/ajprenal.00508.2009

Saratale R.G., Benelli G., Kumar G., Kim D.S., Saratale G.D. Bio-fabrication of silver nanoparticles using the leaf extract of an ancient herbal medicine, dandelion (*Taraxacum officinale*), evaluation of their antioxidant, anticancer potential, and antimicrobial activity against phytopathogens. *Environ. Sci. Pollut. R.* 2018;25:10392–10406. doi: 10.1007/s11356-017-9581-5

Sofowara, A. (1994): Medicinal plant of tropical Africa.Cambridge University press,London .p.76.

Teddy Ehianeta1 , Chimezie Anyakora1 * and Bola Mustapha2 (2013) *Heavy metals content in the stem bark of Detarium microcarpum determined by atomic absorption spectrophotometer* African Journal of Biotechnology Vol. 12(11), pp. 1236-1238, 13 March, 2013 Available online at http://www.academicjournals.org/AJB DOI: 10.5897/AJB12.649 ISSN 1684–5315 ©2013 Academic Journals