QUALITATIVE & QUANTITATIVE PHYTOCHEMICAL SCREENING AND PROXIMATE COMPOSITION OF BOMBAX BUONOPOZENSE (RED SILK COTTON TREE) STEM-BACK

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ABSTRACT

Qualitative & quantitative phytochemical screening and proximate composition of Bombax buonoopozense stem was investigated. Nine phytochemicals viz: - alkaloid, carbohydrate, phenols, flavonoids, saponins, tannins, protein, terpenoids, and oxalates were observed. Steroids and glycosides were below detectable limits. Quantitative phytochemical analysis indicated that alkaloid, flavonoid, phenols, tannins and saponins had values of 0.68 g, 0.09 g, 2.35 g, 1.41 g and 1.15 g respectively. The proximate analysis gave high percentage moisture content (55.30%). Carbohydrate and protein were of low values (1.04 % and 6.0% respectively). Ash content was found to be 15.30%, fiber (16.80%) All analyses were per 100g of crude sample.

Key words: phytochemical screening, proximate composition, Bombax buonoopozense, quantitative / qualitative analysis, stem-back

INTRODUCTION

Screening of phytochemicals is a valuable step in the detection of the bioactive principles present in medicinal plants and subsequently may lead to the discovery and development of drugs (Yadav et al., 2014).

Harborne, 1973 and Okwu, 2004 considered phytochemicals as compounds formed during the plants normal metabolic processes and these chemicals are often referred to as secondary metabolites. Phytochemicals working together with nutrients found in fruits, vegetables and nuts help slow the aging process (Bassey & Khan, 2015) and reduce the risk of many diseases such as cancer, heart disease, stroke, cataracts, osteoporosis and urinary tract infections (Iroka et al., 2014).

Medicinal plants besides being therapeutic agents are also a reliable source of secondary metabolites for a wide variety of chemical constituents which could be developed and use for the treatment of precice/ selective ailments (Yadav et al., 2014). These plants are the reservoirs of potentially useful chemical compounds which could serve as new leads and clues for modern drug design (Vijyalakshmi et al., 2012). Medicinal use of plants range from the administration of the plant roots, barks, stems, leaves, flowers, seeds, to whole plants extracts (Iryang et al., 2008). Onwuka, 2005 defines proximate composition as the determination of the major components of food, which includes: moisture, lipids (fats), ash, proteins, fiber and carbohydrates.

Bombax buonoopozense

Bombax buonoopozense is of the family Malvaceae formerly Bombacaceae and is commonly known as Gold coast Bombax or red flowered silk cotton tree (Beentje et al., 2001). It is known by the following local names: Akpe (Igbo), Ponpola (Yoruba), Kurya (Hausa), Ukim (Elik) and IdoUndu (Ijaw). It is native primarily to West Africa where it is found in rainforests of Sierra Leone in the North West, East Gabon and some parts of Nigeria (Beentje et al., 2001). It is a large tree and often reaches heights of 40 meters (130 feet) and up to 3 meters trunk diameter. The bark of younger trees is covered with spine but sheds the spine with age to some degree and large deep pink to red flowers emerge while the tree is leafless (GRIN, 2007). According to Beentje et al., 2001 and Germplasm Resources Information Network, 2007; many parts of this plant are utilized for medicinal and traditional purposes.

Medicinal plants contain compounds that are potential drugs candidates and could rightly be recommended for further examinations. The activeprinciples/ secondary metabolites differ from plant to plant due to their biodiversity and produce definite physiological actions on the human body (Edeoga et al., 2006) the rationale for phytochemical screening and proximate analyses of plants being done constantly even on those secondary metabolites already known (Temitopeet al., 2012).

This work therefore is aimed at screening the stem back of B. buonoopozense for the presence of secondarymetabolites and its proximate composition.

MATERIALS AND METHODS

(Sample collection, preparation and analysis)

The fresh stem of Bombax buonoopozense was collected from an open farmland in Hildi Village of Hong Local Government Area of Adamawa State, Nigeria in November, 2015. The plant was cited from existing collections deposited at
the Herbarium in Ibadan, an international herbarium listed in Holmgren et al., 1990. *Bombax buonopozense* P. Beauv, has Forestry Herbarium Index Number FHI108415 and a specimen of the plant is deposited in the herbarium there. The sample was rinsed in water to remove dust and was dried under shade after which it was then pulverized into fine powder using laboratory mortar and pestle. The pulverized crude sample was then analyzed for:

**Qualitative phytochemical screening**

Standard analytical procedures as described by Harbone, 1973; Trease and Evans, 1989; Sofowora, 1993 and Aluko et al., 2000 were adopted for the identification of the constituents.

**Quantitative phytochemical screening**

Analysis was carried out on the powdered sample using standard analytical procedures as described by Harbone, 1973; Bolim et al., 1994; Ubadoni et al., 2001 for the quantities of the constituents.

**Proximate composition**

Ash, carbohydrate, crude fiber, fat, moisture and protein contents were analyzed for (AOAC 2000).

**RESULTS AND DISCUSSION**

The results of each analyte (Table 1) are calculated averages of three (3) analytical values. Statistical values were obtained using IBM-SPSS software version 22, 2015 edition and are presented as mean ± SD.

| Table 1: proximate (%) composition of *B. buonopozense* stem-back |
|-----------------------------|------------------|
| **Constituents** | **Values (%)** |
| Ash | 15.30±0.005 |
| Carbohydrate | 1.04±0.000 |
| Crude fiber | 16.80±0.005 |
| Fat | 10.00±0.000 |
| Moisture | 55.30±0.005 |
| Protein | 6.00±0.000 |

Values are mean ± SD

The carbohydrate value was obtained via difference i.e.

\[ 100 - (\text{Values of ash + crude fiber + protein + fat + Moisture content}) \]

The above values are expressed as % by weight.

The crude protein value was found to be 6.0%. A value comparable to the value of *Moringa oleifera* 8.65% (Adeyemi et al., 2012), *Ceiba pentandra* 9.74% (Olujubi, 2015) and 4.70% for *Jatropha curcas* as documented by Atamgba et al., 2015.

The fat value was 10.00±0.000 % which is higher than that reported for *Costus afer* stem (Bush cane) 2.48% (Uwemedimo, 2012). This is analogous to the value (9.6%) acknowledged by Adeyemi et al., 2012, for *Moringa oleifera* but lower than that documented for *Jatropha curcas* stem (16.70%) Atamgba et al., 2015.

The ash content which is a measure of the non-volatile inorganic constituents remaining after ashing was found to be 15.30% which is comparable to *Costus afer* (Bush cane) as documented by Uwemedimo et al., 2012 with a value of 14.21% and 11.83% for *J. curcas* stem and 18.62% for water leaf respectively.

The carbohydrate content and crude fiber of the sample were found to be 1.04% and 16.80%. The bush cane stem is documented to have carbohydrate and crude fiber contents of 20.14% and 14.02% respectively (Uwemedimo et al., 2012). Atamgba et al., 2015; reported 50.53% (crude fiber) and 12.23% (carbohydrate) for *J. curcas* stem and (Iroka et al., 2014) reported 19.75% (crude fiber) and 31.85% (carbohydrate) for *Ceiba pentandra* stem.
Table 2: Summary of qualitative phytochemical screening of *B. buonopozense* stem-back

| Phytochemical components | Test          | Observation       | Inference |
|--------------------------|---------------|-------------------|-----------|
| Alkaloid                 | Wagner's      | Reddish precipitate | +         |
| Carbohydrate             | Benedict's    | Orange red precipitate | +         |
| Phenols                  | Ferric chloride | Bluish black colour | +         |
| Flavonoids               | Alkaline reagent | Yellow precipitate | +         |
| Saponins                 | Froth         | 1cm layer of form | +         |
| Tannins                  | Galatin       | White precipitate | +         |
| Protein                  | Xanthoproteic | Yellow colour     | +         |
| Steroids                 | Steroid’s     | Violet colour     | -         |
| Glycosides               | Legals’       | Blood red colour  | -         |
| Terpenoids               | Salkowski     | Reddish brown colour | +         |
| Oxalates                 | Ethanoic      | Red precipitate   | +         |

+ = present, - = below detection limit.

Table 2 above gives a tabular presentation of the phytochemicals present or below detection limit in the plant sample. These phytochemicals / secondary metabolites are known to have antimicrobial activities which are a property of most medicinal plants (Bassey and Khan, 2015).

Alkaloids are said to be pharmacologically active and are known to exhibit marked physiological activities (Okwu, 2004). Their actions are felt in the autonomic nervous system, blood vessels, promotion of diuresis, respiratory system, gastrointestinal tract, uterus, malignant diseases and malaria (Trease and Evans, 1996). However, pure isolated plant alkaloids and their synthetic derivatives are used as basic medicinal agents for analgesics, antispasmodic and bacterial effects (Stray, 1998).

Plants containing carbohydrates, glycosides and proteins are known to exert a beneficial action on the immune system by increasing body strength, and hence are valuable as dietary supplements (Yadav et al., 2014). Glycosides also have a vast therapeutic efficacy as they are found in almost every medicinal plant (Yadav et al., 2014).

The presence of flavonoids in the stem-back indicates the medicinal value of the plant (*B. buonopozense*). Hence, flavonoids are antioxidants and free radical scavengers which prevent oxidation; they have strong anticancer activity and also protect the cell against all stage of carcinogenesis (Salah et al., 1995; Okwu, 2004). In addition, flavonoids in the intestinal tract lower the risk of heart disease (Okwu, 2004). Flavonoids and flavones are widely distributed secondary metabolites with antioxidant and antiradical properties (Nakayoma and Yamada, 1995). This suggests that taking foods rich in flavonoids help to reduce the risk of heart diseases, and this is of great importance in pharmacology, medicine and human nutrition. In addition, flavonoids are phenolic in nature, and they act as cytoplasmic poisons which have been reported to inhibit the activity of enzymes (Dathak and Iwu, 1991). The antioxidant properties of flavonoids may be responsible for the ability of some selected plants, such as *Fucus virosa* to treat several diseases like arthritis, anaemia and others.

Tannins have amazing stringent properties. They are known to hasten the healing of wounds, and inflamed mucous membranes. They are well known for their antimicrobial properties; therefore, this suggests that they may be useful in the treatment of venereal diseases and also help to regenerate the skin (Okwu, 2004).

These secondary metabolites contribute significantly towards the biological activities of medicinal plants such as hypoglycemic, anti-diabetic, antioxidant, antimicrobial, anti-inflammatory, anti-carcinogenic, anti-malarial, anti-cholinergic, anti-leprosy activities (Negi et al., 2011).
cover bioactive natural products that may show activities. Phenols present in the plants indicate that it can be used to make disinfectants (Dettol and other disinfectants) for their nearness to the inhabitants. Thus, plants are responsible for the activity. There is need for further studies on the plants parts in order to isolate, identify, characterize, and elucidate the structure(s) of active principles as earlier indicated.

| Components       | Values (g/100g) |
|------------------|-----------------|
| Alkaloids        | 0.68±0.028      |
| Flavonoids       | 0.09±0.000      |
| Phenols          | 2.35±0.015      |
| Tannins          | 1.41±0.000      |
| Saponins         | 1.15±0.023      |

Values are mean ± SD

The above statistical results were calculated as triplicate values and expressed as mean ± SD using IBM-SPSS software version 22, 2015 edition and expressed as g/100 g of sample.

The alkaloids value obtained in the stem was 0.68±0.028 g/100 g of the sample. This value is lower compared to that of Manihot esculentus 7.02g/100 and Ceiba patandra 3.79g/100g (Okeke, 2009). Alkaloids are known to exhibit marked physiological activity when administered to animals (Okwu, 2003). Pure isolated plant alkaloids and their synthetic derivatives are used as basic medicinal agents for analgesics, anti-spasmodic and bacterial effects (Stray, 1998). However, excessive intake of alkaloid tends to disrupt the normal functioning of the central nervous system.

Flavonoids value obtained in the stem was 0.09±0.000 g/100g, this value is comparable to that documented by (Eyong et al., 2011) for Manihot esculentus with a value 0.51g/100g and lower than that documented by (Okeke, 2009) for Ceiba patandra with value of 1.14g/100g. The presence of flavonoids in the plant, indicates a medicinal value hence, flavonoids are antioxidants and free radical scavengers which prevents oxidation and in the intestine lower the risk of heart diseases (Okwu, 2003).

The tannin value obtained was 1.41±0.000g/100g. This value is higher than the value reported for Ceiba pentandra0.83 g/100g as documented by (Okeke, 2009). Tannins present in plant have been found to possess astringent properties which hasten the healing of wounds and inflamed mucus membranes (Okwu, 2003).

Saponin value was found to be 1.15±0.023 g/100g. This value is lower than the value of Manihot esculentum and Ceiba pentandra documented by (Eyong et al., 2011) and (Okeke, 2009) with values of 13.21 and 2.43 respectively. Saponins are used in the manufacture of shampoos, insecticides, various drugs preparation and in the synthesis of steroidal hormones (Dubrousky, 2005). However, excessive consumption of Saponins could be dangerous as they cause haemolysis of blood and are known to cause cattle poisoning (Kar, 2007).

The phenol value was found to be 2.35±0.015 g/100g. This value is higher than that documented by (Okeke, 2009) with the value 0.08 for Ceiba pentandra. Phenols present in the plants show that it can be used to make disinfectant and antiseptics that are used in mouth wash surface cleansing Dettol and other disinfectants.

The presence and quantities of these phytochemicals in the plant sample may have complementary and overlapping mechanisms of action in the body such as anti-oxidant effects, modulation of detoxification enzymes, stimulation of metabolism, anti-bacterial and anti-viral effects. And the values obtained from the quantitative phytochemical screening of the plant shows that these values are comparable to other plant samples as earlier indicated and as such B. buonopozense stem can be utilized for several medicinal purposes.

CONCLUSION

From the analysis carried out on the sample; it was deduced that the sample contains phytochemicals, thus making it suitable for industrial purposes like in pharmaceutical and cosmetic industries. Therefore, the stem-back extract of B. buonopozense can be used to uncover bioactive natural products that may serve as lead for the development of new pharmaceutical agents to address unmet therapeutic needs. Such screening of various natural organic compounds and identification of active agents is of paramount importance since medicinal plants have become a house whole name with majority of humanity depending on them for their existence. This is because they are comparably offewer side effects, arecost effective and for their nearness to the inhabitants. Thus, plants are either consumed as food (the leaves, twigs, flowers, roots and stems) as well as for ethno medicinal purposes.

RECOMMENDATION

There is need for further studies on the plants parts in order to isolate, identify, characterize, and elucidate the structure(s) responsible for the activity.
REFERENCES

1. Manjula J Yadav, Sanjukta Chatterji, Sharad Kumar Gupta and Geeta Watal (2014): preliminary Phytochemical Screening of Six medicinal Plants used in traditional medicine. International Journal of Pharmaceutical Sciences Vol 6(5) pp 539-542.

2. Harborne J.B. (1973): Phytochemical methods.Chapmanand Hall Ltd, London 1973; 279.

3. Okwu E.D. (2004): Phytochemicals and Vitamin content of indigenous spices of South Eastern Nigeria. Journal of sustenance of AfricaEnvironment;6:30-34.

4. E. B. Bassey, M.E. Khan (2015): Proximate Composition and Phytochemical Analysis of bombax buonopozense leaves (Gold Coast Bombax). Int. J. Curr. Res. Chem. Pharma, Sci. 2(11): (2015): 51–56

5. Iroka Finian Chisom,Okereke Chukwu N, Okeke C. U. (2014): Comparative phytochemical and proximate analyses on Ceiba pentandra (L) Gaertn. And Bombax buonopozense (P) Beav.: InternationalJournal of Herbal Medicine 2014; 2(2): 162-167

6. Vijyalakshmi R, Ravindran R. : Preliminary comparative phytochemical screening of root extracts of Diospyrus ferrea(Wild.) Bakh and Arva lanata (L.) Juss. Ex Schultes. Asian J PlantSci Res 2012; 2:581-587.

7. C. U. Inyang, and A. A. Adيكoko (2008): Antimicrobial Properties and Phytochemical Screening of Chromoleana odorata (Siam or Sapysa weed) leaf. Nig. Jorn. Of Microbiology, vol. 22(1): 1652-1659

8. Beentje H., Smith S. (2001): Plant systematic and Phytogeography for the understanding of African Biodiversity. Systematic and Geography of plants;71(2):234-286.

9. Gernplasm Resources Information Network (Network) (2007/GRIN"Bombax" http://www.ars-grin.gov

10. Edeoga H. O, Okwu DE, Mbaebei BO (2006). Phytochemicalconstituents of some Nigerian Medicinal plants. Afr. J. Biot. 4(7):685-688

11. Temitope Israel Borokini, Felix Oluwafemi Omotayo(2012): Phytochemical and ethnobotanical study of some selected medicinal plants from Nigeria; Journal of Medicinal Plants Research Vol. 6(7), pp.11061118, 23 February, 2012.

12. AOAC (2000). Association of Official Analytical Chemists. 18th edition. official methods of analysis.Washington dc: pp.18-62

13. Trease G.E, Evans W.C (1989): Textbook of Pharmacognosy. W.B. Sanders, London.14Edition

14. Sofowora A. (1993): Medicinal plants and traditionmedicine in African. Spectrum Books Ltd, IbadanNigeria, 2nd Edition, 1993,289.

15. Bolim j.m "Nutritional and chemical evaluation of Momordica charantia", Journal of Medicinal Plants Research. 1994, Vol. 4(21), 2189-2193.

16. Ubadoni ochuko,Adourn, O.A., Akinniyi, J.A. and Omar, T. (2001): The effect of geographical location on the antimicrobial activities and trace element concentration in the root of Calotropis procera (Alt.) R. Br. Annals of Borno 13(14) :199-207.

17. Adeyemi S. A, J. E. Ehiagbonare, and S. C. O. Nwangwu, “Nutritional evaluation of some staple leafy vegetables in Southern Nigeria”, International Journal of Agricultural and Food Science, 2012, Vol. 2(2), 37-43.

18. Olugbile Wasagu (2015): Evaluation of phytochemical and anti-oxidant levels and antimicrobial screening of aqueous leaf extract of Aloe vera (Aloe barbadensis MILLER). Biological and Environmental Sciences Journal for the Tropics 2(2) :21-25.

19. Atamgba Agbor Asuk, Margaret Akpana Agiang, Kayode Dasofunjo, Amonor James Willie (2015): The biomedical significance of the phytochemical, proximate and mineral compositions of the leaf, stem bark and root of Jatropha curcas. Asian Pacific Journal of Tropical Biomedicine.ASian Pac J Trop Biomed 2015; 5(8): 650–657

20. Strait F. (1998): The National Guide to Medicinal Herbs and Plants. Tiger Books InternationalLondon, 1998, 72.

21. Salah W, Miller N.J, Pagauga G, Tijburg G, Bonel A.P, Rice E, Evans C. (1995): Polyphenolic flavonoids as scavengers of aqueous phase radicals as chain breaking oxidant. Arch BiochemBioech 1995; 2:339346.

22. Nakayoma J, Yamada M. (1995): Suppression of active oxygen-induced cyto toxicity by flavonoids. Biochem. Pharmcol., 45: 265-267.

23. Dathak P, Iwu M (1991): Inhibition of Xanthine oxidaseactivity by some flavonoids. Phytother., 63: 385.

24. Negi JS, Singh P, Rawat B. (2011): Chemical composition and biologicalvalues of Swertia: a review. Curr Res Chem 2011; 3:1-15.

25. Okeke C.U, Elekwe I. (2009): Proximate and Preliminary Photochemical Analyses of Avocado Pea Persea gratissima Cacrt. F. (Family Lauracea). Nigeria Journal of Botany, 9(1):159162.

26. Okwu DE, Ekeke O. (2003): Phytochemical Screening and Mineral Composition of Chewingsticks in South Eastern Nigeria. Global journal pure and applied science 2003:9:235-238

27. Eyong M. Andzuana (2011): “Assessment of the chemical and phytochemical constituents of the leaves of a wild vegetable - Occhthocarhis dicellandroides (Gilg)”, Pakistan Journal of Nutrition. 2011, Vol. 11(1), 94-99.

28. Dubrovsky B.O. (2005): Steroids, Neuroactive steroids in psychopathology. Progress in Neuropsychopharmacology and Biological Psychiatry; 29:169-192

29. Ukana D. Akpabio, Uwemedimo E. Udo and Aniekan E. Akpakpan. (2012): Evaluation of phytochemical, proximate and mineral element composition of stem of Costus afer (Bush cane). Asian Journal of Plant Science and Research, 2012, 2 (5):607-612

30. Strait F. (1998): The National Guide to Medicinal Herbs and Plants. Tiger Books International London, 1998, 72.

31. Kar A. (2007).Pharmacoognosy andPharmacoabiotechnology. NewAgeInternationalLimited PublishersNewDelhi. (Revised-ExpandedSecondEdition) pp332-600