**Phytochemical screening of methanolic extracts of *Telfairia occidentalis* (Cucurbitaceae) and *Plumeria rubra* (Apocynaceae) flowers**

**Abstract**

Phytochemicals are plant-based bioactive chemical compounds produced by plants for their protection. These phytochemicals possess different pharmacological functions such as ~~strong~~ antioxidant ~~activities~~, antimicrobial, antidiarrheal and antiviral activities. This work was carried out to qualitatively determine the phytochemical constituents in the methanolic extracts of *Telfairia occidentalis* and *Plumeria rubra* flowers. The results revealed that both extracts contained ~~same quantity of~~ alkaloids, tannins, cardiac glycosides, anthraquinones and saponins. Flavonoids content was more ~~higher~~ in *Plumeria rubra* flowers extracts. These phytochemicals have great and known pharmacological functions. Though percentage of these phytochemicals are low, the extracts can be consumed to alleviate some sickness especially in the rural communities if their cytotoxicity is proven.

**Keywords:** Phytochemicals,*Telfairia occidentalis, Plumeria rubra* and methanol extracts

**1.0 Introduction**

Medicinal plants have long been a rich source of bioactive compounds with diverse pharmacological properties. Phytochemicals, such as alkaloids, flavonoids, tannins, saponins, and phenolic compounds, play significant roles in plant defense mechanisms and have been utilized~~s~~ in various biological functions such as antioxidant, antimicrobial, and anti-inflammatory agents *(*Cowan, 1999*;* Pandey and Rizvi, 2009*).* The identification and screening of these bioactive constituents are essential for understanding their potential applications (Akpakpan, *et al*., 2020). Telfairia occidentalis (commonly known as fluted pumpkin) is a tropical vine belonging to the Cucurbitaceae family. It is widely cultivated in West Africa and is valued for its nutritional and medicinal benefits. Various parts of the plant, including the leaves, roots, stem, seeds, and flowers, have been reported to contain bioactive compounds with hypoglycemic, antimicrobial, and antioxidant properties (Oboh et al., 2006)*.* T. occidentalis is also an important leavy vegetable that is traditionally used for its nutritional and medicinal properties, with reports indicating its efficacy in blood-boosting, antimicrobial, and antioxidant properties ~~activities~~ (Eseyin *et al*., 2014). The phytochemical constituents of T. occidentalis include alkaloids, flavonoids, saponins, and phenolic~~s~~ compounds, which contribute to its potential pharmacological properties (Oboh *et al*., 2006).

Similarly, Plumeria rubra (commonly known as frangipani or temple tree) is an ornamental and medicinal plant belonging to the Apocynaceae family. It has been traditionally used in folk medicine for its analgesic, anti-inflammatory, and antimicrobial properties. Previous studies have identified the presence of flavonoids, alkaloids, and terpenoids in various parts of Plumeria rubra, but its floral phytochemistry remains underexplored (Aluísio *et al*., 2020).

This study aims to conduct a phytochemical screening on the methanolic extracts of Telfairia occidentalis and Plumeria rubra flowers to provide qualitative composition of ~~identify~~ their bioactive components ~~compounds~~. Methanol is commonly used as an extraction solvent due to its ability to dissolve both polar and non-polar phytochemicals, there by maximizing the extraction of a wide range of secondary metabolites. The findings from this study may provide insights into the valorization of traditional uses of both plants in folk medicine for their diverse sicknesses ~~potential medicinal~~ and for industrial applications of these flowers and contribute to the growing body of knowledge on plant-based bioactive compounds.

COMMENTS: the author should provide the brief botanical description of the genus and plants species of this study.

**2.0 Materials and Methods**

**2.1 Sample Collection and Identification**

Fresh flowers of *T. occidentalis* and *P. rubra* ~~Pp~~lants were collected from ~~T~~town ~~C~~campus, University of Uyo, Uyo, Akwa Ibom State, Nigeria. The plant samples were identified and authenticated by a taxonomist in the Department of Pharmacy, Faculty of Pharmacy, University of Uyo, where a voucher specimen was deposited in the Herbarium which Herbarium??? with identification number UUPH 6(j). The flowers were collected, washed with distilled water to removed sand and dirty, then ~~and~~ were air-dried at room temperature for 12 hours to removed excess moisture before being sliced into pieces.

**2.2 Preparation of the ~~E~~extract**

The ~~natural indicator~~ extracts were prepared by weighing 100 gramsof *T. occidentalis* and *P. rubra* fresh flowers crushed, then macerated with methanol (95%) in a glass extraction jar for 24 hours. The solutions of the samples were filtered into a new clean glass jar of the same size, capped with a Teflon cap and store for use. Half of the filtrate obtained was pre-concentrated using a rotary evaporator at 40 oC to obtain the crude extracts (Abuh *et al.,* 2018 and Simran *et al.,* 2020), which was weighed (what is their mass?) and stored in the refrigerator for further studies.

**2.3 Phytochemical Screening**

The qualitative Phytochemical Screening was carried out on the extracts of *T. occidentalis* and *P. rubra* flowers using standard method to investigate on ~~identify~~ the classes of chemical compounds present (Sofowora 1993; Evans 2009).

**2.4 Test for Alkaloids**

The extracts (0.5 g) were separately stirred with 5 cm3 of 1% HCl in a small beaker on a water bath for 5 min and filtered. The filtrates were then divided into two test tubes respectively:

1. to the first portions, few drop of Dragendoff’s precipitating reagent were added and observed. A pink or red precipitate was taken as indication of the presence of alkaloids.
2. to the second portions, few drops of Meyer’s regents were added and observed. Turbidity was taken as evidence of the presence of alkaloids (Evans, 2009).

**2.5 Test for Flavonoids**

**(i) Magnesium metal test:** Few pieces of magnesium metal were added to the flower extracts solutions (5 mL) formed by dissolving the extracts in concentrated hydrochloric acid. An orange colour indicated the presence of flavonoids (Evans, 2009).



**Equation 1: Mechanism of Magnesium Reaction with Flavonoids**

**(ii) Sodium hydroxide test**: the extract (0.5 g) was dissolved in 2 mL~~l~~ of distilled water. 5% of sodium hydroxide was gently added. A yellow colo~~u~~ration indicates the presence of flavonoids (Evans, 2009).



**Equation 2: Mechanism of Sodium Hydroxide Reaction with Flavonoids**

 **2.6 Test for Terpenoids:** The extracts (0.5 g) were separately shaken with 5 cm3 of chloroform. 5 mL of concentrated tetraoxosulphate (IV) acid was added. A reddish-brown colo~~u~~ration of the interphase indicates the presence of terpenoids (Evans, 2009).

**2.7 Test for Tannins**

**(i) Ferric chloride test:** The extracts (0.5 g) were mixed with 10 cm3 of distilled water and filtered. Ferric chloride was added to the filtrate. A blue-black precipitate was seen as evidence for the presence of tannins (Evans, 2009).

 **2.8 Test for Saponins**

**(i) Frothing test:** The extracts (0.5 g) were shaken vigorously with 10 cm3 of distilled water in a graduated measuring cylinder for 15minutes. Frothing which persisted on warming indicated the presence of saponnins (Sofowora, 1993).

**(ii) Sodium bicarbonate test:** The extracts (0.5 g) were mixed with 5% of sodium bicarbonate and Fehling’s solution A and then boiled. The presence of a brown precipitate was termed as positive test (Evans, 2009).

**2.9 Test for Anthraquinones**

**(i) Combined Anthraquinones:** The extracts (0.5 g) were boiled with 2 cm3 of aqueous tetraoxosulphate (IV) acid and filtered while hot. The filtrates were shaken with 1 cm3 of toluene. Ammonia solution (10%) was then added to the toluene layer and shaken. The presence of pink, red or violet colour in the ammonical layer indicated the presence of combined anthraquinones in the extracts (Sofowora, 1993).

**(ii) Free Anthraquinones:** The extracts (0.5 g) were treated with 5 cm3 of toluene, filtered and 2 mL of 10% ammonia solution added to the toluene layer and shaken. The presence of pink, red or violet colour in the ammonical layer indicated the presence of free hydroxyl anthraquinones in the extracts (Sofowora, 1993).

**2.10 Test for Cardiac Glycoside**

**(i) Salkwoski’s test:** The extracts (0.5g) were dissolved in 2 cm3 of chlorofoam. Concentrated sulphuric acid was gently added by running it down the side of the test tube to form a distinct lower layer. A reddish colouration at the interphase indicated the presence of a steroidal cardiac glycoside (Sofowora, 1993).

 (ii) **Keller-Killiani Test:** The extracts (0.5 g) were dissolved in 2 cm3 of glacial acetic acid containing one drop of ferric chloride solution. The solutions were then underlaid with 1ml concentrated tetraoxosulphate (IV) acid by slowly running it down the side of the test tube to form

a distinct lower layer. A brown ring at the interphase indicates the presence of cardiac glycoside (Evans, 2009).

**(ii) Lieberman’s test:** the extracts (0.5 g) were dissolved in 2 cm3 acetic anhydride and cooled well in ice. Concentrated tetraoxosulphate (IV) acid was carefully added to form the lower layer. A colour change from violet to blue to green was taken as evidence for the presence of a steroidal nucleus: the aglycone portion of the cardiac glycoside (Evans, 2009).

**RESULTS AND DISCUSSION**

|  |  |  |  |
| --- | --- | --- | --- |
| **Composition** |  **Test** | **Observation** | **Inference** |
| Alkaloids  | Dragendoff’s reagent Meyer’s reagent | Red precipitateA milky colour |  **++** **++** |
| Tannins |  Ferric chloride | Blue black precipitate |  **+** |
| Cardiac glycosides |  Salkwoski’s testKeller killiani testLieberman’s test | Brown ring formed at interphaseBrown ring formed at interphaseA pink colouration at the interphase |  **+** **+** **+** |
| Flavonoids | Magnesium metal testSodium hydroxide test | Orange colourationA yellow colouration |  **+** **+** |
| Anthraquinones  | Combine anthraquinoneFree anthraquinone | Light pink colourationLight pink colouration |  **+** **+** |
| Saponins  | Frothing test | Persistent frothing |  **++** |

The results of the phytochemical analysis of the methanol extracts of *T. occidentalis* and *P. rubra* flowers showed that it contained diverse ~~certain~~ phytochemicals as shown in the Table 1 and 2 respectively.

**Table 1: phytochemical analysis of the methanol extract of *T. occidentalis* flower**

**Table 2: Phytochemical analysis of the methanol extract of *P. rubra* flower**

|  |  |  |  |
| --- | --- | --- | --- |
| **Composition** | **Test** | **Observation** | **Inference** |
| Alkaloids  | Dragendoff’s reagent Meyer’s reagent | Red precipitateA milky colour | **++** **++** |
| Tannins |  Ferric chloride | Blue black precipitate |  **+** |
| Cardiac glycosides |  Salkwoski’s testKeller killiani testLieberman’s test | Brown ring formed at interphaseBrown ring formed at interphaseA pink colouration at the interphase |  **+** **+** **+** |
| Flavonoids | Magnesium metal testSodium hydroxide test | Orange colourationA yellow colouration | **++****++** |
| Anthraquinones  | Combine anthraquinoneFree anthraquinone | Light pink colourationLight pink colouration |  **+** **+** |
| Saponins  | Frothing test | Persistent frothing | **++** |

***Keys:*** *++ = present; +~~+~~ = moderately present*

Thephytochemical screening of the methanolic extract of *T. occidentalis*flowers presented in (Table 1) revealed the presence of alkaloids and saponins in moderate concentration, while tannins, cardiac glycosides, flavonoids, anthraquinone were low in concentration. The result of the phytochemical screening of the methanol extract of *P. rubra* presented in (Table 2) revealed the presence of alkaloids, saponins and flavanoids in moderate concentration. Cardiac glycosides, anthraquinone and tannins were presence in low concentration. These results are also in accordance with the work ~~findings~~ of Egwaikhide *et al.* (2009) which revealed the presence of alkaloids, tannins, flavonoids, and terpenes. *T. occidentalis*and*P. rubra* flowers were observed to contain highly polar bioactive compounds which may be attributed to the choice of solvent as reported by Obi and Onuoha (2000) that alcohol is the best solvent for extraction of most secondary plant metabolites. *P. rubra* was found to possess ~~have~~ the highest ~~mean~~ concentration~~s~~ of flavonoids than *T. occidentalis* extracts.~~,~~ Flavonoids are polyphenols which are ~~only~~ synthesized in plants,**~~Flavonoids~~** usually act as a powerful antioxidant in human that help in reducing oxidative stress and inflammation (Oboh *et al*., 2006). Both extracts have the same average concentration of alkaloids, tannins, cardiac glycosides and saponins. Alkaloids play a significant role in medicine, with diverse applications ranging from pain relief and antimalaria, anticancer treatment, antimicrobial and cardiovascular benefits (Akpabio *et al.*, 2012a; Uwanta *et al*., 2024). Their wide-ranging biological activities continue to make them valuable source~~s~~ of pharmaceutical drugs. Cardiac glycosides are a class of organic compounds that have significant effects on heart function. It remains essential in the management of heart diseases, particularly heart failure and arrhythmias (Akpakpan *et al.,* 2017; Akpabio *et al*., 2012b). Instead of the low concentration of these bioactive components, ~~Hence~~ the flower extracts can be utilized to fight against certain of the said diseases. ~~in the treatment of these diseases.~~

**Conclusion**

The phytochemical screening of the crude methanolic extracts of *Telfairia occidentalis* and *Plumeria rubra* flowers revealed the presence of various bioactive compounds. *P. rubra* exhibited a higher concentration of flavonoids compared to *T. occidentalis*. Flavonoids, being potent antioxidants, play a crucial role in reducing oxidative stress and inflammation in human~~s~~ body. Additionally, the presence of alkaloids, saponins, cardiac glycosides, anthraquinones, and tannins in varying concentrations suggests that these plants possess significant pharmacological properties ~~potential~~ which can be assigned to the said various family of secondary metabolites. These findings support the medicinal relevance of *P. rubra* and *T. occidentalis*, highlighting their potential uses in natural therapies and drug formulations. These flower extracts may also be used in skin care applications and as natural indicators for acid- base titrations

**References**

Abuh, L. O., Akor, J. A., Abdullahi, Y. and Egu, S. A. (2018). Ethanolic extracts of *Telfairia occidentalis* and *Abelmoschus esculentus* flowers as substitutes to hazardous synthetic indicators in acid - base titration. *International Journal of Chemical Science,* 2(4) 16-19.

Akpabio, U. D., Udo, Uwemedimo, E. and Akpakpan, A. E.(2012a). Evaluation of Phytochemical, proximate and mineral element composition of stem of costus after (Bush cane). ***Asian*** *Journal of Plant Science and Research* 2(5): 607-612.

Akpabio, U. D., Wilson, L. A., Akpakpan, A. Eand I. B. Obot (2012b). Phytochemical Screeing and proximate composition of Cassia hirsute seeds. ***Elixir Journal of Applied Chemistry*** *8704-8707.*

Akpakpan, A. E. Ukpong, E. J. Odiongenyi, A. O. and Willie, I. E. (2017)Phytochemical Screening of the Ethanol and Aqueous Extracts of *Dicliptera verticillata* Leaves. *Archives of Current Research International**11(2): 1-5*

Akpakpan, A. E., Uwanta, E. J., Akpan, P. E. and Owen, A. E. (2020). Phytochemical screening and analytical assessment of acid-base indicator properties of red and white kola nuts extracts. *Asian Journal of Advances in Research*3(1): 1-7

Aluísio Marques da Fonseca, Octavio Lisboa Guterres Fernandes, Regilany Paulo Colares et al. (2020). “Phytochemical study and evaluation of the biological activity of the species jasmim (Plumeria rubra L.)”, *International Journal of Development Research,* 10, (01), 32985-32995.

Egwaikhide, P. A., Okeniyi, S. O. And Gimba C. E. (2009). Anti-microbial activity and phytochemical constituents of some Nigerian medicinal plants. *Journal of Medicinal Plants Research*, 3(12), 1088-1091

Eseyin, O. A., Sattar, M. A. and Rathore, H. A. (2014). A Review of the Pharmacological and Biological Activities of the Aerial Parts of *Telfairia occidentalis* Hook.f. (Cucurbitaceae), *Tropical Journal of Pharmaceutical Research*, 13 (10), pp. 1761-1767.

Evans, W. C. (2009). Trease and Evans Pharmacognosy. 16th edition London, Saunders Elservier Limited, 137-144.

Kumar, M., Prakash, S. O. and Kumar, S. M. (2012). Photochemical Treatment of Methyl red Waste Water by Photo-Fenton reagent. *International Journal of Resource Chemistry and Environment*, 2, 87–92.

Obi, V. I. and Onuoha, C. (2000). Extraction and Characterization Methods of Plants and Plant products: Ogbulie, J. N.& Ojiako, O. J. (Eds): *Biological and Agricultural Techniques*, 271–288.

Oboh, G., Nwanna, E. E. and Elusiyan, C. A. (2006). Antioxidant and antimicrobial properties of *Telfairia occidentalis* (Fluted pumpkin) leaf extracts. *Journal of Pharmacology and Toxicology*, 1: 167-175.

Oboh, G., Nwanna, E. E. and Elusiyan, C. A. (2006). Antioxidant and antimicrobial properties of *Telfairia occidentalis* (Fluted pumpkin) leaf extracts. *Journal of Pharmacology and Toxicology*, 1: 167-175.

Simran, A. P., Ujwala, D., Suchita, G. and Suraj, R. (2020). Study of Ethanolic Extract on Different Species of Plumeria as Herbal Indicator. *Indo American Journal of Pharmaceutical Research*, 10(4) 689-694.

Sofowora, A. (1993). Screening Plants for Bioactive Agents: Medicinal Plants and Traditional Medicine in Africa. 2nd Edition, Spectrum Books Ltd., Sunshine House, Ibadan, Nigeria, 134-156.

Uwanta, E. J., Udo, I. E., Willie, I. N., and Akpakpan, A. E. (2024). Phytochemical screening, proximate and vitamin composition of Jack fruit (Artocarpus Heterophyllus) pulp and seed. *World Journal of Advanced Research and Reviews*, *22*(1), 1500-1506.