**Comparative Phytochemical Analysis of Methanolic Extracts of *Telfairia occidentalis* and *Plumeria rubra* Flowers: A Preliminary Qualitative Screening**

**Abstract**

This study aims to conduct a phytochemical screening on the methanolic extracts of Telfairia occidentalis and Plumeria rubra flowers to identify their bioactive compounds. Phytochemicals are secondary metabolites, but they serve multiple roles, including plant defence, attraction of pollinators, and environmental adaptations. . 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 the same quantity of alkaloids, tannins, cardiac glycosides, anthraquinones and saponins. Flavonoid content was higher in *Plumeria rubra* flower extracts. These phytochemicals have great pharmacological functions. Though the percentage of these phytochemicals is low, the extracts can be consumed to alleviate some sicknesses, especially in rural communities. The presence of alkaloids, saponins, cardiac glycosides, anthraquinones, and tannins in varying concentrations suggests that these plants possess significant pharmacological potential. These findings support the medicinal relevance of *P. rubra* and *T. occidentalis*, highlighting their potential use in natural therapies and drug formulations. The findings from this study may provide insights into the potential medicinal and industrial applications of these flowers and contribute to the growing body of knowledge on plant-based bioactive compounds.

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

**1.0 Introduction**

Medicinal plants have long been a rich source of bioactive compounds with diverse pharmacological properties . Several bioactive substances found in medicinal plants include, among others, alkaloids, flavonoids, terpenoids, phenolics, and essential oils. These substances' pharmacological characteristics, such as their antibacterial, antioxidant, anti-inflammatory, anticancer, and immunomodulatory actions, have been thoroughly investigated (Dar et al., 2023; Chaachouay, N., & Zidane, 2024). Phytochemicals, such as alkaloids, flavonoids, tannins, saponins, and phenolic compounds, play significant roles in plant defence mechanisms and have been utilised 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 an important leafy vegetable that is traditionally used for its nutritional and medicinal properties, with reports indicating its efficacy in blood-boosting, antimicrobial, and antioxidant activities (Eseyin *et al*., 2014). The phytochemical constituents of T. occidentalis include alkaloids, flavonoids, saponins, and phenolics, which contribute to its pharmacological potential (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). Previous study also revealed that the extract of these flowers can serve as an alternative indicator for titrimetric analysis (Akpakpan *et al*., 2025)

This study aims to conduct a phytochemical screening on the methanolic extracts of Telfairia occidentalis and Plumeria rubra flowers to identify their bioactive compounds. Methanol is commonly used as an extraction solvent due to its ability to dissolve both polar and non-polar phytochemicals, thereby maximizing the extraction of a wide range of secondary metabolites. The findings from this study may provide insights into the potential medicinal and industrial applications of these flowers and contribute to the growing body of knowledge on plant-based bioactive compounds.

**2.0 Materials and Methods**

**2.1 Sample Collection and Identification**

Fresh flowers of *T. occidentalis* and *P. rubra* Plants were collected from the Town 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 with identification number UUPH 6(j). The flowers were collected, washed with distilled water to remove sand and dirt and were air-dried at room temperature for 12 hours to remove excess moisture before being sliced into pieces.

**2.2 Preparation of the 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 stored for use. Half of the filtrate obtained was pre-concentrated using a rotary evaporator at 40 C to obtain the crude extracts (Abuh *et al,* 2018 and Simran *et al,* 2020), which were weighed 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 methods to 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. In the first portions, a few drops of Dragendoff’s precipitating reagent were added and observed. A pink or red precipitate was taken as an indication of the presence of alkaloids.
2. In the second portion, a 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:** A 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 of distilled water. 5% of sodium hydroxide was gently added. A yellow colouration 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 colouration 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 15 minutes. Frothing which persisted on warming indicated the presence of saponins (Sofowora, 1993).

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

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

**Table 1: Phytochemical analysis of the methanol extract of *T. occidentalis* 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 | A brown ring formed at interphaseA brown 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*

**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 interphaseA brown 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 as presented in Table 1 revealed the presence of alkaloids and saponins in moderate concentration, while tannins, cardiac glycosides, flavonoids, and 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 flavonoids in moderate concentration. Cardiac glycosides, anthraquinone and tannins were present in low concentrations. These results are also following the 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 have the highest mean concentrations of flavonoids than *T. occidentalis* extracts, flavonoids are polyphenols which are only synthesized in plants, **flavonoids** usually act as a powerful antioxidant in humans that help in reducing oxidative stress and inflammation (Oboh *et al*., 2006). Both extracts have the same average concentration of alkaloids, tannins, cardiac glycoside and saponin. Alkaloids play a significant role in medicine, with diverse applications ranging from pain relief and antimalaria, to anticancer treatment, and antimicrobial and cardiovascular benefits (Akpabio *et al.*, 2012a; Uwanta *et al*., 2024). Their wide-ranging biological activities continue to make them valuable sources of pharmaceutical drugs. Hence the flower extracts can be utilized in the treatment of these diseases.

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)

**Conclusion**

The phytochemical screening of 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 humans. Additionally, the presence of alkaloids, saponins, cardiac glycosides, anthraquinones, and tannins in varying concentrations suggests that these plants possess significant pharmacological potential. These findings support the medicinal relevance of *P. rubra* and *T. occidentalis*, highlighting their potential use 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

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