Determination of Phytochemical Constituents of Epiphytes in the Federal Capital Territory, Nigeria

Abstract

A study on the diversity and classification of epiphytes in the Federal Capital Territory (FCT) was conducted on thirty (30) species of epiphytes. As an extension of the research work, fifteen (15) epiphytic plants were selected on the basis of data collected by administering semi-structured questionnaires to 90 respondents. The interest of this work is to determine the phytochemical constituents of *Ficus platyphylla, Senna mimosifolia, Platycerium stemaria, Nephrolepsis bisserata, Calyptrochilum emerginatum, Frullania dilatata, Perperomia pellucida, Plagiothecium undulatum, Pitrogramma calomelanos, Caprinus lagopides, Auricularia polytrichia, Formitopsis* sp, *Lycopodium clavatum and Entodon seductrix* in the federal capital territory, to determine their uses. A qualitative phytochemical study procedure including a test for alkaloids was conducted using the Mayer-Wagner test. A few drops of Wagner's reagent were added to a few ml of plant extract along the sides of the test tube. A reddish-brown precipitate confirmed that the test was positive. Further qualitative tests involving saponins were performed, and a two-cm foam layer indicated the presence of saponins. Alkaloid

test: The extract (1 g) was macerated with 20 ml ethanol and 20% hydrogen sulphate (H2SO4), ($_{1:1\ V/V).\ The}$ filtrate (1 ml) was added to 5 ml of 60% H2SO4, and the absorbance read at 565 nm. Test for phenolic compounds and tannins: To test for phenolic compounds, the extract (1g) was macerated with 20 ml of 80% ethanol and then filtered. The filtrate (5 mL) was added to 0.5 mL of folinciocalteus reagent and allowed to sit for 30 minutes, and absorbance was measured at 650 nm. By testing the tannins, the extract (1g) was macerated with 50ml of methanol and filtered. To the filtrate (5 mL), add 0.3 mL of 0.1N ferric chloride in 0.1N hydrogen chloride (HCl) and 0.3 mL of 0.0008M potassium ferricyanide, and the absorbance was read at 720 nm. The result of the quantitative analysis of the flavonoid components of the epiphytes studied showed that the flavonoid content varied between 4.29 mg/100 and 52.61 mg/100. *Calyptechium emerginatum* has the highest flavonoid content of 52.61 while the lowest was *Entodontpsis nitens* with 4.29. A scientific justification for their use is required; Hence the need to determine the phytochemical constituents of certain epiphytic species. Why and in what interest? The need to develop baseline data on the phytochemical constituents and ethnobotany of some epiphytic species in the Federal Capital Territory cannot be overemphasized; Hence the basis of this study. You mentioned the constituents that are found in these plants and you didn't even do an analysis?

Keywords: phytochemicals, epiphytes, constituents, medicinal, biological

Introduction:

The classes of compounds found in epiphytes often trigger and encourage the diverse use of epiphytes in the medicinal treatment of certain diseases, and other uses, example. Modern researchers seek to explore the basis of plant use in various areas of human activity. In many habitats, epiphytes have been used as antibiotics, decorations, dyes, natural remedies, stabilizers for fragrance and food for thousands of years (Alamgir, 2017). It is a centuries-old culture and tradition in most African communities to use epiphytes as vegetables, ornamental plants and for the treatment of certain diseases. Nigeria is not to be outdone in this regard. A scientific justification for their use is required; Hence the need to determine the phytochemical constituents of certain epiphytic species already seen in the abstract identified in this study. The need to develop baseline data on the phytochemical constituents and ethnobotany of some epiphytic species in the Federal Capital Territory cannot be overemphasized; Hence the basis of this study.

Epiphytes and orchids are a source of food and habitat for other organisms (Migiro 2019). Orchids are good bio-indicators due to their low tolerance to changes in their environment (Akhaltatsi *et al.*, 2014).

A global assessment of the uses and misuses of orchids, including epiphytic species in medicine, was made, and summarized some important uses of orchids in the

control of fevers, curing eye diseases, treating fatigue, headaches and they function as anti-cancer agents have been reported misformed phrase by Humagain and Shrestha (2010). In Brazil, the leaves of *Loranthus rotundifolius* Engl. cooked in milk have been used to treat chest diseases (Subhashini *et al.,* 2019). An ointment prepared from the young shoots and leaves of *L. citrocolus* is a well-known remedy for edematous tumours (Shanavaskhan *et al.,* 2012). *Cypripedium parviflora* is widely used as an aphrodisiac and nerve tonic (Singh *et al.,* 2012).

In the mid-eighteenth century, regular crops were severely affected in Europe by frosts and droughts causing famine, and as a result, lichens were used for food due to their easy availability, cheapness, and nutritional value (Luczaj and Pieroni, 2016).

Most lichens are poisonous, although there are some exceptions. *Letharia vulpine* (L.) has been traditionally used to poison predators and treat stomach disorders; more recently, *extracts of L. vulpine* have demonstrated promising antimicrobial properties (Shrestha *et al.,* 2016). According to Gray in GBIF Secretariat (2023), *Cetraria pinastri* (Scop.) Gray is used as a poison for wolves**.** *Bryoria fremontii* is edible whereas other *Bryoria* species are mildly toxic (Chandler *et al.* 2020). *B. tortuosa* is a well-known toxic lichen rich in vulpinic acid or pinastrinic acid (Spribille *et al.* 2016). They have also been used in traditional foods for millennia

and play a critical role in ecosystem functioning and human well-being (Crawford, 2015).

Bryophytes can contribute significantly to total stream metabolism, nutrient cycling, interactions with food webs in streams, and as a direct food source for some invertebrates (Tessler *et al.* 2014). Some species are a great source for herbal medicine (Sabovljevic *et al.*, 2016). However, to date, there has been no attempt to document FCT bryophytes as to their medicinal properties, ethnic and other uses.

Traditional communities depend on wild plants for food, healing, and building materials, firewood, and almost all other material crops (Vira *et al.*, 2015).

Ethnobotanical research with traditional communities

Different parts of the world have greatly helped the modern world to benefit from the traditional knowledge systems (Kumar *et al.*, 2021). This has been recognized, mainly in the areas of developing promising life-saving drugs, including plant-based psychotomimetics (Crawford, 2015), by gaining knowledge about the traditional land and plant use model (Bradai *et al.*, 2015), evolving strategies

for the conservation of biological diversity and environmental management policies (Santamaria and Mendaz, 2012) and the search for promising new economic plants and land races (Shah, 2014). Tribals living in the area are known to have a great knowledge of the medicinal uses of many of these plants (Mahomoodally, 2013).

Since FCT is a treasure trove of ethnic communities, some no effort has been made to date to record ethnobotanical information on the FCT. Because of the difficulty of obtaining the plants from other higher plants, information on these groups is very scarce. No one has so far attempted to record this information. Therefore, the present study is a new endeavor to enumerate the epiphytes of FCT, and to record ethnobotanical information from this group of plants.

A scientific justification for their use is required; hence the need to determine the phytochemical constituents of certain epiphytic species that have been identified in the "Diversity and Classification of Epiphytes in the Federal Capital Territory". The need to develop baseline data on the phytochemical constituents and ethnobotany of some epiphytic species in the Federal Capital Territory cannot be overemphasized; Hence the basis of this study.

Too long an introduction, the researcher cited several other plants that have no relation to the plant studied

Materials and methods

Qualitative and quantitative phytochemical analysis of plants

This was achieved as described by Yadav and Agarwala (2011).

Qualitative Phytochemical Survey Procedure

Test for alkaloids

one. Mayer's test

To a few ml of plant sample extract, two drops of Mayer's reagent were added along the sides of the tube. The appearance of a creamy white precipitate indicated the presence of alkaloids.

b. Wagner's test

A few drops of Wagner's reagent were added to a few ml of plant extract along the sides of the test tube. A reddish-brown precipitate confirmed that the test was positive.

Test for saponins

The extract (100 mg) was dissolved in 10 ml of distilled water and composed of 20 ml.

The suspension was shaken in a graduated cylinder for 15 minutes. A two-cm layer of foam indicated the presence of saponins. (figure?)

Test for phenolic compounds and tannins

has. Ferric Chloride Test

The extract (50 mg) was dissolved in 5 mil of distilled water. To this, a few drops of neutral 5% ferric chloride solution were added. A dark green colour indicated the presence of a phenolic compound. (figure?)

b. Lead Acetate Testing

The extract (50 mg) was dissolved in distilled and to which 3 ml of 10% lead acetate solution was added. A large white precipitate indicated the presence of phenolic compounds. (figure?)

c. Magnesium and hydrochloric acid reduction

The extract (50 mg) was dissolved in 5 ml of alcohol and a few fragments of magnesium tape and concentrated hydrochloric acid (drip) were added. A pink to crimson color developed, the presence of flavonol glucosides was inferred. (figure?)

Quantitative Phytochemical Investigation Procedure

Test for saponins:

The extract (1 g) was macerated with 10 ml of petroleum ether and transferred to a beaker. Another 10 ml of petroleum ether was added to the beaker and the filtrate evaporated until it became dry. The residue was dissolved in 6 ml of ethanol. The solution (2 ml) was put into a test tube and 2 ml of chromagen solution was added.

It was left to rest for 30 minutes and the absorbance was read at 550 nm. (figure with reaction?)

Test for alkaloids

The extract (1g) was macerated with 20ml of ethanol and 20% hydrogen sulphate (H2SO4), (1:1 V/V). The filtrate (1 mL) was added to 5 mL of 60% H2SO4. After 5 minutes, 5 mL of 0.5% formaldehyde in 60% H2SO4 was mixed into the mixture and allowed to sit for 3 hours. The absorbance was read at 565 nm. (figure with reaction?)

Test for phenolic compounds and tannins

To test for phenolic compounds, the extract (1 g) was macerated with 20 ml of 80% ethanol and then filtered. The filtrate (5 mL) was added to 0.5 mL of folinciocalteus reagent and allowed to sit for 30 minutes, and absorbance was measured at 650 nm. (figure?)

To test the tannins, the extract (1g) was macerated with 50ml of methanol and filtered. To the filtrate (5 mL), add 0.3 mL of 0.1N ferric chloride in 0.1N hydrogen chloride (HCl) and 0.3 mL of 0.0008M potassium ferricyanide, and the absorbance was read at 720 nm. (figure?)

Result

Using analysis of variance, quantitative analysis of the flavonoid content of the selected epiphytes showed a significant difference between epiphytes (P< 0.000). The F-value (160.12) and the P-value (0.000) communicate the difference in significance.

Certains des épiphytes à savoir ; *Ageratum conyzoides, Ficus platyphylla, Senna mimosifolia, Platycerium stemaria, Nephrolepsis sp, Calyptechium emerginatum, Frullaria dilatata, Perperomia pelucilia, Plagiothecium undulatum, Pitrogramma sp, Caprinus lagopides, Auricularia polytrichia, Formitopsis sp, Lycopodon spadiceus* and *Entodon nitens were* subjected to qualitative and quantitative phytochemical analysis to determine their phytochemical constituents. These epiphytes were selected based on data collected by administering semi-structured questionnaires to 90 respondents for a single-purpose face-to-face interview.

Table 1: Qualitative phytochemical analysis of the epiphytes studied (mg/100g)

Epiphytes	Flavonoid	Saponins	Alkaloid	Tannin	carbohydrate	Steroid	Terpene
Ageratum conyzoides	++	+	++	++	+	++	+
Ficus platyphylla	++	++	++	++	+	+	++
Senna Mimosillo	++	++	++	+	+	+	++
Platycerium stemaria	+	++	++	+		++	+

Nephrolepsis sp	++	++	++	++	+	+	+
Calyptechium emerginatum	++	++	++	+	+	+	++
Dilated frullar	+	++	++	++	+	++	++
French Perperper	++	++	++	+	++	+	+
Plagiothecium undulatum	+	++	+	++	++	+	+
Pitrogramma sp	++	++	++	++	++	+	+
Caprinus lagopides	+	++	++	+	+	+	
Auricularia polytrichia	+	++	++	++	+	++	+
Formitopsis sp	+	++	++	++	+	++	
Lycopodon spadiceus	+	++	++	++	++	+	++
Entodontpsis nitens	+	+	++	+	+	+	+

KEY:

+ = Present

++ = Moderately present

A quantitative analysis of the flavonoid components of some FCT epiphytes was performed in replicates. The result showed that the flavonoid content of the epiphytes studied varied between 4.29 mg/100 and 52.61 mg/100. *Calyptechium*

emerginatum has the highest flavonoid content (52.61), while the lowest was *Entodontpsis nitens* (4.29), as shown in Table 2 below.

Using analysis of variance, quantitative analysis of the flavonoid content of the selected epiphytes showed a significant difference between epiphytes ($P< 0.05$). The F-value (160.13) and the $P<$ value 0.05 communicate the difference in significance.

Table 2: Quantitative phytochemical analysis of the epiphytes studied (mg/100g)

Epiphytes	**Flavonoid**	**Saponins**	**Alkaloid**	**Tannin**	**Carbohydrates**	**Steroid**	**Terpene**
Ageratum conyzoides	45.00	19.07	25.67	17.77	36.76	12..11	20.20
Ficus platyphylla	33.17	25.43	31.68	26.34	18..6; l	17.34	21.11
senna mimofolia	16.91	15.77	18.68	19.45	19.5	19.31	18.81
Platycerium stemaria	10.39	13.62	21.13	21.16	18.2	21.23	20.10
Nephrolepsis sp	27.41	26.93	22.07	21.46	11.38	19..10	22.25
Calyptechium emerginatum	52.61	15.62	21.04	20.84	65.12	23.61	28.41

Dilated frullar	6.71	19.29	16.92	27.38	80.01	19.20	60.12
Pellucida Perperomia	50.63	10.87	21.50	23.42		21.70	20.70
Plagiothecium undulatum	10.40	24.17	16.51	24.28	70.23	22.66	35.6
Pitogramme sp	46.11	52.00	21.39	18.82	26.11	26.22	23.4
Caprinus lagopides	4.52	14.48	18.95	27.95	2.50	16.32	25.67
Auricularia polytrichia	24.78	18.18	20.90	19.82	60.10	28.12	32.11
Formitopsis sp	17.52	20.64	14.86	26.95	2.34	21.31	28.23
Lycopodon spadiceus	11.89	17.31	16.92	21.37	5.00	3.30	27.60
Entodontpsis nitens	4.29	10.43	19.86	15.92	35’60	25.43	23.22

Discussion

For many years, nature has been a source of medicinal agents and a whole bunch of modern medicines have been isolated from natural sources. This is because plants have the ability to produce a wide variety of secondary metabolites such as saponins, tannins, phenols, alkaloids, triterpens, and phytosterols. In the current qualitative analysis of selected epiphytes in the Federal Capital Territory, the results indicated the presence of saponins, flavonoids, alkaloids, tannins, steroids, terpenes, and carbohydate in all plants (Table: 2). It has been reported that tannins have various physiological effects such as anti-irritant, antisecretolytic, Antiphlogistics, antimicrobials and antiparasitics How did you come to this conclusion?. In addition, there are reports showing that tannin contains plants the opposite, plants contain tannin with phytotherapeutic effect. Phytochemical analysis of some plant extracts revealed the presence of constituents known to have medicinal values as well as physiological activity. Phytochemicals such as alkaloids, flavonoids, tannins, saponins, terpenes, and steroids have been associated with medicinal properties (Rabizadeh *et al*., 2022). Phytochemicals are known to be the basic source for the establishment of several pharmaceutical industries. Constituents present in plants play a crucial role in the identification of crude drug references. In addition, phytochemical screening is a very useful tool for identifying the new source of therapeutically and industrially important compounds. Epiphytes play an important role in the treatment of certain diseases, beautification and nutrition. This has

undoubtedly led to other uses of *Ageratum conyzoides* L. as an analgesic, against fungal, inflammatory, anticoagulant activity, wound healing, dysentery, pesticides, and herbicides (Sivakrishnan and Kavitha, 2017). *Ficus platyphylla* Delile is used as a drug for the treatment of diarrhea, chest pain, cough, seizures, and pain (Ugwah-Oguejiofor *et al.,* 2021). *Senna mimosifolia* Mill is used to treat gastrointestinal diseases, it causes rectal cancer when used excessively (Oladeji *et al.* 2021). It is also used for weight loss by drinking tea made from its fresh leaves. Prolonged use of *Senna mimosifolia tea* can lead to liver degradation and cause bowel dysfunction (Oluwole *et al.,* 2021). According to the International Plant Names Index and the World Checklist of Vascular Plants (2024), *Platycerium stemaria* (P. Beauv.) Desv. Used in the treatment of diseases associated with blood circulation, liver disease, genital stimulation or depression, asthma and infectious diseases. The curled young leaves of *Nephrolepsis bisserata* (Sw.) Schott are used as food for humans, medicines, biofertilizers, and ornaments (Shah *et al.* 2014). *Calyptrochilum emerginatum* (Afzel.ex Sw.) Schltr. is used in the treatment of cough (Mathias *et al.,* 2006), tuberculosis and malaria (Okhale et al. 2014).

According to Plant Basel (2023), *Frullania dilatata* (L.) Dumort. causes intense allergenic contact dermatitis *Perperomia pellucida* (L.) Kunth serves as a remedy for insect bites, sexually transmitted diseases, fever, cough, smallpox, measles, and kidney infections (Keat Lam *et al.,* 2022). *Plagiothecium undulatum* (Hedw.)

Schimp. is used in the treatment of malaria in north-central Nigeria (Evbuomwan *et al.,* 2023). The leaves of *Pitrogramma calomelanos* (L.)Link ex Britton and Millsp. are used externally to heal wounds and stop bleeding (DeFilipps *et al.,* 2024). An infusion of the whole plant is used to strengthen the backs of men; i.e., increasing male sexual stamina and treating female bleeding (DeFilipps *et al.*, 2024). It is also used to treat asthma, coughs, colds, pneumonia, tuberculosis, and pertussis (DeFilipps *et al.,* 2024). *Caprinus lagopides* P.Karst. is not toxic (N'Douba Amako *et al.,* 2022). Its edibility is unknown, but it is considered too small to be worthwhile (Davis and Sommer 2014). *Auricularia polytrichia* (Mont.) Sacc. is used as an antioxidant, antitumor, immunomodulatory, hyperlipidemic, antidiabetic, anticoagulant, and hepatoprotectant (Miao *et al.,* 2020). *Formitopsis* sp (Sw.) P.Karst. has therapeutic effects, including anti-inflammatory, cytotoxic, and antimalarial effects (Muszynsk *et al.,* 2020). According to Plant Resources of Tropical Africa (2022), *Lycopodium clavatum* (L.) stimulates peristaltic movements of the intestine and contraction of the uterus. The whole plant is chewed to induce vomiting after poisoning or sharp stomach pains and it is applied externally on skin diseases, wounds, ulcers, and irritations. *Entodon seductrix* (Hedw.) Müll.Hal. causes skin reactions, contact dermatitis, can be used to treat liver disorders, cardiovascular disease, fever, and wounds (Bandyopadhyay and Dey, 2022).

Research indicates that *Ageratum conyzoides* L. is used as an analgesic, against fungal, inflammatory, anticoagulant activity, wound healing, dysentery, pesticides and herbicides (Sivakrishnan and Kavitha, 2017). *Ficus platyphylla* Delile is used as a drug for the treatment of diarrhea, chest pain, cough, seizures, and pain (Ugwah-Oguejiofor *et al.,* 2021). *Senna mimosifolia* Mill is used to treat gastrointestinal diseases, it causes rectal cancer when used excessively (Oladeji *et al.*, 2021). It is also used for weight loss by drinking tea made from its fresh leaves. Prolonged use of *Senna mimosifolia tea* can lead to liver degradation and cause bowel dysfunction (Oluwole *et al.,* 2021). According to the International Plant Names Index and the World Checklist of Vascular Plants (2024), *Platycerium stemaria* (P. Beauv.) Desv. Used in the treatment of diseases associated with blood circulation, liver disease, genital stimulation or depression, asthma and infectious diseases. The curled young leaves of *Nephrolepsis bisserata* (Sw.) Schott are used as food for humans, medicines, biofertilizers, and ornaments (Shah *et al.* 2014). *Calyptrochilum emerginatum* (Afzel.ex Sw.) Schltr. is used in the treatment of cough (Mathias *et al.,* 2006), tuberculosis and malaria (Okhale *et al.,* 2014).

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Conclusion

The present research concludes that some epiphytes are important medicinal plants and contain various active phytoconstituents. These constituents have made some epiphytic plants poisonous, while others serve as food, medicine, or ornaments. It is therefore necessary to develop further research on these epiphytes to determine their medicinal value. Conclusion

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