Determination of the 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 carried out on thirty (30) species of epiphytes. In furtherance of the research work, fifteen (15) epiphytic plants were selected based on the data collected by administering semi-structured questionnaires to 90 respondents. The significance 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 ascertain their uses. Qualitative phytochemical survey procedure involving test for alkaloids was conducted using Mayer's and Wagner's test. A few drops of Wagner's reagent were added to a few ml of plant extract along the sides of test tube. A reddish-Brown precipitate confirmed the test as positive. Further qualitative test involving Saponins was done, and a two cm layer of foam indicated the presence of saponins. Test for Alkaloids:

The extract (1g) was macerated with 20ml of ethanol and 20% Hydrogen Sulphate (H_2SO4), (1:1 V/V). The filterate (1ml) was added to 5mls of 60% H_2SO4, and the absorbance read at 565nm. Test for Phenolic Compounds and Tannins: To test for Phenolic compounds, the extract (1g) was macerated with 20ml of 80% ethanol and then filtered. The filterate (5ml) was added to 0.5ml of folinciocalteus reagent and allowed to stand for 30 minutes, and absorbance measured at 650nm. Testing for Tannins, the extract (1g) was macerated with 50ml of methanol and filtered. To the filtrate (5ml), 0.3ml of 0.1N ferric chloride in 0.1N Hydrogen Chloride (HCl) and 0.3ml of 0.0008M of potassium ferricyanide added, and the absorbance was read at 720 nm. A The result of the quantitative analysis of the flavonoid components of the studies epiphytes showed that the flavonoid content ranged between 4.29 mg/100 to 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 uses is required; hence the need to determine the phytochemical constituents of some epiphytic species. The need to develop baseline data on the phytochemical constituent and ethnobotany of some epiphyte species of the Federal Capital Territory cannot be over emphasized; hence the basis for this study.

Keywords: phytochemicals, epiphytes, constituents, medicinal, biological

Introduction:

The classes of compounds present in the epiphytes will often trigger and encourage the diverse use of epiphytes in medicinal treatment of some diseases and other uses. Modern researchers seek to explore the basis for the utilization of plants in various fields of human endavour. In many habitats, epiphytes are used as antibiotics, decorations, dyes, natural remedies, stabilizers for perfume and food for thousands of years (Alamgir, 2017). It is an age long culture and tradition in most African Communities to use epiphytes as vegetables, ornamentals and for the treatment of some diseases. Nigeria is not left out in this regard. A scientific justification for their uses are required; hence the need to determine the phytochemical constituents of some epiphytic species that were identified in this study. The need to develop baseline data on the phytochemical constituent and ethnobotany of some epiphyte species of the Federal Capital Territory cannot be over emphasized; hence the basis for this study.

Epiphytes and Orchids are source of food and habitat for other organisms (Migiro, 2019). Orchids are good bio-indicators because of low tolerance for 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

controlling fevers, curing eye diseases, treating fatigue, headaches and they function as anticancer agents have been reported by Humagain and Shrestha (2010). In Brazil, the leaves of *Loranthus rotundifolius* Engl. cooked in milk have used to cure chest diseases (Subhashini *et al.*, 2019). An ointment prepared from the young shoots and leaves of *L. citrocolus* is remedy of repute for oedematous tumours (Shanavaskhan *et al.*, 2012). *Cypripedium parviflora* is widely used as aphrodisiac and nerve tonic (Singh *et al.*, 2012).

During the mid-eighteenth century, regular crops were badly affected in Europe by frosts and droughts causing famine, and as a consequence, lichens were used for food because of their easy availability, cheapness and nutritive value (Luczaj and Pieroni, 2016).

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

millennia and play vital roles in ecosystem function and human welfare (Crawford, 2015).

Bryophytes can be important contributors to the total stream metabolism, nutrient cycling, food web interactions in streams, and as direct food source for some invertebrates (Tessler *et al.,* 2014). Some species are of great source for herbal medicine (Sabovljevic *et al.,* 2016). However, to date, there have been no attempts to document FCT Bryophytes as to its medicinal properties, ethnic uses and others.

Traditional communities depend on wild plants for food, medicine, and construction materials, fuel wood, and nearly for all other material cultures (Vira *et al.,* 2015). Ethnobotanical investigations conducted among the traditional communities in different parts of the world have greatly helped the modern world benefit from the traditional knowledge systems (Kumar *et al.,* 2021). This has been acknowledged, mainly in the fields of developing promising life-saving drugs including psychotomimetic drugs of plant origin (Crawford, 2015), gaining knowledge on traditional land and plant utilization pattern (Bradai *et al.,* 2015), evolving strategies for conservation of biological diversities and policies for environment management (Santamaria and Mendaz, 2012) and searching out promising new economic plants

and land races (Shah, 2014). The tribals, living in the region are known to possess great knowledge on the medicinal uses of many of these plants (Mahomoodally, 2013). Since FCT is a treasure house of ethnic communities, some ethnobotanical, no efforts have so far been made to record the ethnobotanic information on the FCT. Owing to the difficulty in procuring the plants from other higher plants, tribal information on these groups are very scanty. Nobody has so far attempted to record this information. Hence, the present study is a new venture to enumerate the epiphytes of the FCT, and to record the ethnobotanic information of this group of plants,

A scientific justification for their uses are required; hence the need to determine the phytochemical constituents of some epiphytic species that were identified in the "Diversity and Classification of Epiphytes in the Federal Capital Territory". The need to develop baseline data on the phytochemical constituent and ethnobotany of some epiphyte species of the Federal Capital Territory cannot be over emphasized; hence the basis for this study.

Materials and Methods

Qualitative and Quantitative Phytochemical Analysis of Plant

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

Qualitative Phytochemical Survey Procedure

Test for Alkaloids

a. Mayer's test

To a few ml of plant sample extract, two drops of Mayer's reagent were added along sides of tube. Appearance of white creamy 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 test tube. A reddish-Brown precipitate confirmed the test as positive.

Test for Saponins

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

The suspension was shaken in graduated cylinder for 15 minutes. A two cm layer of foam indicated the presence of saponins.

Test for Phenolic Compounds and Tannins

a. Ferric Chloride test

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

b. Lead acetate test

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

c. Magnesium and Hydrochloric acid reduction

The extract (50 mg) was dissolved in 5 ml of alcohol and few fragments of magnesium ribbon and concentrated hydrochloric acid (drop wise) were added. Pink to crimson colour developed, presence of flavonol glucosides was inferred.

Quantitative Phytochemical Survey Procedure

Test for Saponins:

The extract (1g) was macerated with10ml of petroleum ether and decanted into a beaker. Another 10ml of the petroleum ether was added into the beaker and the filtrate evaporated into dryness. The residue was dissolved in 6ml of ethanol. The

solution (2ml) was put in a test tube and 2ml of chromagen solution added into it. It was left to stand for 30 minutes and the absorbance was read at 550nm.

Test for Alkaloids

The extract (1g) was macerated with 20ml of ethanol and 20% Hydrogen Sulphate (H_2SO4), (1:1 V/V). The filterate (1ml) was added to 5mls of 60% H_2SO4. After 5 minutes, 5ml of 0.5% formaldehyde in 60% H_2SO4 was mixed with the mixture and allowed to stand for 3 hours. The absorbance was read at 565nm.

Test for Phenolic Compounds and Tannins

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

To test for Tannins, the extract (1g) was macerated with 50ml of methanol and filtered. To the filtrate (5ml), 0.3ml of 0.1N ferric chloride in 0.1N Hydrogen Chloride (HCl) and 0.3ml of 0.0008M of potassium ferricyanide added, and the absorbance was read at 720 nm.

Result

Using analysis of variance, the quantitative analysis of the flavonoid contents of the selected epiphytes showed a significant difference among the epiphytes ($P< 0.000$).

The F – Value (160.12) and P – Value (0.000) communicating the significance difference.

Some of the epiphytes namely; *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 the 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 Studied Epiphytes (mg/100g)

Epiphytes	Flavonoid	Saponin	Alkaloid	Tanin	carbohydrate	Steroid	Terpene
Ageratum conyzoides	++	+	++	++	+	++	+
Ficus platyphylla	++	++	++	++	+	+	++
Senna mimosifolia	++	++	++	+	+	+	++
Platycerium stemaria	+	++	++	+		++	+
Nephrolepsis sp	++	++	++	++	+	+	+

Calyptechium emerginatum	++	++	++	+	+	+	++
Frullaria dilatata	+	++	++	++	+	++	++
Perperomia pelucila	++	++	++	+	++	+	+
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 selected epiphytes of the FCT was carried out in replicates. The result showed that the flavonoid content of the studied epiphytes ranged between 4.29 mg/100 to 52.61 mg/100. *Calyptechium*

emerginatum has the highest flavonoid content of 52.61 while the lowest was *Entodontpsis nitens* with 4.29 as shown in table 2 below.

Using analysis of variance, the quantitative analysis of the flavonoid contents of the selected epiphytes showed a significant difference among the epiphytes (P< 0.05). The F – Value (160.13) and P< Value 0.05 communicating the significance difference.

Table 2: Quantitative Phytochemical Analysis of the Studied Epiphytes (mg/100g)

Epiphytes	**Flavonoid**	**Saponin**	**Alkaloid**	**Tannin**	**Carbohydrate**	**Steroid**	**Terpen**
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
Frullaria dilatata	6.71	19.29	16.92	27.38	80.01	19.20	60.12
Perperomia pelucida	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
Pitogramma 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 an a whole lot of modern drugs have been isolated from natural sources .This is because plants have the ability to produce a large variety of secondary metabolites such as saponins, tannins, phenols, alkaloids, triterpens and phytosterols. In present qualitative analysis of some epiphytes of the Federal Capital Territory, the results indicated the presence of saponins, flavonoids, alkaloids, tanins, steroids, terpenes and carbohydate in all plants (Table: 2). Tannins have been reported to have various physiological effects such as anti-irritant, antisecretolytic, antiphlogistic, antimicrobial and antiparasitic effects. Also, there are reports showing that, tannin contains phytotherapeutic effect plants. Phytochemical analysis conducted on some plant extracts revealed the presence of constituent which are known to exhibit medicinal values as well as physiological activity. Phytochemical such as alkaloids, flavonoids, tannins, saponins, terpens and steroids have been associated with medicinal properties (Rabizadeh *et al.*, 2022). The phytochemicals are known to be the basic source for the establishment for several Pharmaceutical industries. The constituents that are present in the plants play a crucial role in the identification of crude drugs. Also, phytochemical screening is a very useful tool in identifying the new source of both the therapeutically and industrial important compounds. Epiphytes play a significant role in the treatment of some diseases, beautification

and food. This has no doubt led to further *Ageratum conyzoides* L. is used as analgesic, against fungal, inflammatory, anticoagulant activity, healing of wound, dysentery, pesticides and herbicides (Sivakrishnan and Kavitha, 2017). *Ficus platyphylla* Delile serves as medicine for the treatment of diarrhea, chest pain, cough, convulsion and pain (Ugwah-Oguejiofor *et al.*, 2021). *Senna mimosifolia* Mill is used to treat gastrointestinal diseases, it causes cancer of the rectum when used excessively (Oladeji *et al.* 2021). It is also used for weight loss by drinking tea made from its fresh leaf. Prolonged use of *Senna mimosifolia* tea can lead to liver breakdown and cause malfunctioning of the bowels (Oluwole *et al.*, 2021). According to International Plant Names Index and World Checklist of Vascular Plants (2024), *Platycerium stemaria* (P. Beauv.) Desv. serves in the treatment of diseases associated with blood circulation, liver related ailment, genital stimulation or depression, asthma and infectious diseases. Young curled-up leaves of *Nephrolepsis bisserata* (Sw.) Schott are used as food for humans, medicine, biofertilizer 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 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 men's backs; i.e. increase male sexual stamina and to treat female hemorrhaging (DeFilipps *et al.*, 2024). It is also used to treat asthma, cough, cold, pneumonia, tuberculosis and whooping cough (DeFilipps *et al.,* 2024). *Caprinus lagopides* P.Karst. is nonpoisonous (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 antioxidant, antitumor, immunomodulatory, hyperlipidemic, antidiabetic, anticoagulant and hepatoprotective effects (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 the peristaltic movements of the intestine and contraction of the uterus. The whole plant is chewed to induce vomiting after poisoning or acute stomach pain and it is applied externally to skin diseases, wounds, ulcers and irritations. *Entodon seductrix* (Hedw.) Müll.Hal. causes skin reactions, contact dermatitis, may be used to treat hepatic disorders, cardiovascular diseases, fever and wound (Bandyopadhyay and Dey, 2022).

The research indicates that *Ageratum conyzoides* L. is used as analgesic, against fungal, inflammatory, anticoagulant activity, healing of wound, dysentery, pesticides and herbicides (Sivakrishnan and Kavitha, 2017). *Ficus platyphylla* Delile serves as medicine for the treatment of diarrhea, chest pain, cough, convulsion and pain (Ugwah-Oguejiofor *et al.,* 2021). *Senna mimosifolia* Mill is used to treat gastrointestinal diseases, it causes cancer of the rectum when used excessively (Oladeji *et al.,* 2021). It is also used for weight loss by drinking tea made from its fresh leaf. Prolonged use of *Senna mimosifolia* tea can lead to liver breakdown and cause malfunctioning of the bowels (Oluwole *et al.,* 2021). According to International Plant Names Index and World Checklist of Vascular Plants (2024), *Platycerium stemaria* (P. Beauv.) Desv. serves in the treatment of diseases associated with blood circulation, liver related ailment, genital stimulation or depression, asthma and infectious diseases. Young curled-up leaves of *Nephrolepsis bisserata* (Sw.) Schott are used as food for humans, medicine, biofertilizer 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 work concludes that some epiphytes are important medicinal plants and contains various active phytoconstituents. These constituents have made some of epiphytic plants poisonous while some serve as food, medicines or ornaments. Thus there is need to develop further research on these epiphytes to ascertain their medicinal value.

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