

CHAPTER 7

Qualitative phytochemical screening of a medicinally-ornamental wild fern species (*Pteris vittata* L.) of India

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Abstract: Qualitative phytochemical screening of *Pteris vittata* leaf was carried out using different extracts (aqueous, ethanol and acetone). The results revealed that tannin, saponin, phenolic compounds and reducing sugar were commonly present in all three extracts. Steroids only present in acetone extract while absent in other remaining extracts of *P. vittata* leaf. The presence of these bioactive compounds indicates the pharmacological potential of this pteridophyte. Further research analysis is needed for the isolation and characterization of different active compounds and to examine their biological activities which could be helpful for the development of novel pharmaceuticals.

Keywords: Biological activities, novel pharmaceuticals, phytoconstituents, pharmacological potential

Introduction

Since the 1940s, when antibiotics were first used in medicine, concerns about their use have been acknowledged (Aslam *et al.*, 2018). Antimicrobial usage has been rising since then, as

has its frequently improper use (Kumar *et al.*, 2013). Serious infections have been linked, at least in part, to antimicrobial drugs. Strong medications called antibiotics are used to treat illnesses that were once fatal. Like any potent drug, antibiotics have a long list of side effects. When these medicines are used appropriately, the benefits greatly exceed the hazards (Zhao *et al.*, 2019). Nevertheless, people who take antibiotics beyond what is necessary do not benefit and remain susceptible to the adverse effects (Llor and Bjerrum, 2014). Antibiotics also change the makeup of the infectious agent, which causes bacterial adaptation or mutations and, eventually, the emergence of new strains of bacteria resistant to the prescribed antibiotic regimen (Ventola, 2015). Antibiotic misuse poses a serious public health risk since it can lead to the development of a resistant strain in one patient that spreads to other patients who do not take antibiotics (Kumar *et al.*, 2017). Research and the creation of novel drugs to combat the various resistance patterns allowed medicine to keep ahead of the antimicrobial resistance curve in the past. Therefore, for above problems, need lot of sources for novel antimicrobial agents (Dimri *et al.*, 2024) and the perfect source is unexplored plants from plant diversity (Devi *et al.*, 2024). Among the unexplored plant species, ferns are more important (Cao *et al.*, 2017; Kumar, 2024). Keeping this in view, an attempt has been made to document the bioactive compounds available in *Pteris vittata*. It is a terrestrial and generally grows on laterite walls and cervices. Rhizome is sub-erect, covered by ovate-lanceolate scales at the apex (Nandan *et al.*, 2021). It has ethnomedicinal uses and used to treat epilepsy (Irfan *et al.*, 2024), cold, cough and fever (Kartik *et al.*, 2011).

Methodology

Collection of plant sample and preparation of extracts

The plant was collected from the roadsides of CDA 11 of Cuttack district of Odisha state in June 2024 (Figures 1-2). The species was identified by the senior author. The Soxhlet method of extraction was adopted using different solvents for phytochemical analysis (Devi *et al.*, 2023). Detection of nine secondary metabolites was carried out using standard methods (Kumar and Jena, 2014). An herbarium specimen is deposited to the Herbarium Unit of Biodiversity and Conservation Lab, Ambika Prasad Research Foundation, Odisha, India.

Qualitative phytochemical analysis

Test for tannin

About 1 ml of the extract was taken. Added 3-5 drops of 10% lead acetate solution into it. The gelatinous precipitate formation confirmed the presence of tannin (Jena *et al.*, 2024).

Test for saponin

About 1 ml of the extract was taken and added with 1 ml of distilled water. After addition shaken it well and observed the persistent froth formation confirmed the presence of saponin.

Test for flavonoids

About 1 ml of the extract was taken. Added 2 ml of 2% NaOH solution and 3 to 4 drops of dilute HCL. The colour initially turned to an intense yellow colour with NaOH solution and later became colourless. This change in colours confirmed the presence of flavonoids.



Figure 1: Collection of *P. vittata* in the field

Test for terpenoids

About 1 ml of the filtrate was added with 6 drops of chloroform and placed it in the water bath for few minutes. Then 6 drops of concentrated H_2SO_4 were added. The reddish-brown interface confirmed the positive result for the presence of terpenoids.

Test for phenolic groups

About 1 ml of the filtrate was taken. Few drops of 5% Ferric chloride solution were added. The dark bluish black provides the positive result of the test for phenolic groups.

Test for reducing sugars

About 1 ml of the extract was taken and 2 drops of Fehling's solution A followed by Fehling's solution B were added and kept it in water bath for some time. The presence of red orange precipitate confirmed the presence of reducing sugar.

Test for steroids

About 1 ml of the extract was taken. 1 ml of chloroform and 1 ml of concentrated sulphuric acid was added into it. The appearance of upper red and lower yellow with green fluorescence provide the presence of steroids.

Test for alkaloids

About 1 ml of the extract was taken and added 3 to 4 drops of Dragendroff's reagent. The formation of reddish-brown precipitate confirmed the presence of alkaloids.

Test for carbonyl compounds

About 1 ml of the extract was taken and added 3 to 4 drops of 2,4- Dinitrophenylhydrazine (DNPH) reagent. The formation of yellow crystal confirmed the presence of carbonyl compounds.



Figure 2: Collected leaves of *P. vittata* for experimental work

Results and discussion

Results of phytochemical screening (Figures 3-5) revealed that tannin, saponins, phenolic compounds and reducing sugar were present in the extracts taken for experimental analysis (aqueous, ethanol and acetone). Steroids only present in acetone extract while absent in other remaining extracts. Details are tabulated in Table 1. The presence of rich phenolic compounds and flavonoids indicate the antioxidant properties of *P. vittata* (Singh *et al.*, 2015). Kaur *et al.*, (2021) documented the antigenotoxic, antioxidant and antiproliferative activities of n-butanol fraction from *P. vittata*. Mohany *et al.*, (2023) documented the cytotoxic activity of *P. vittata* and autophagic pathways.

Table 1: Phytochemical screening of secondary metabolites using different extracts of *P. vittata* leaf

Bioactive compounds	Aqueous	Ethanol	Acetone
Tannin	+ve	+ve	+ve
Saponin	+ve	+ve	+ve
Flavonoids	-ve	-ve	-ve
Terpenoids	-ve	-ve	-ve
Phenolic compounds	+ve	+ve	+ve
Reducing sugar	+ve	+ve	+ve
Steroids	-ve	-ve	+ve
Alkaloids	-ve	-ve	-ve
Carbonyl compounds	-ve	-ve	-ve

(+ve: positive; -ve: negative)

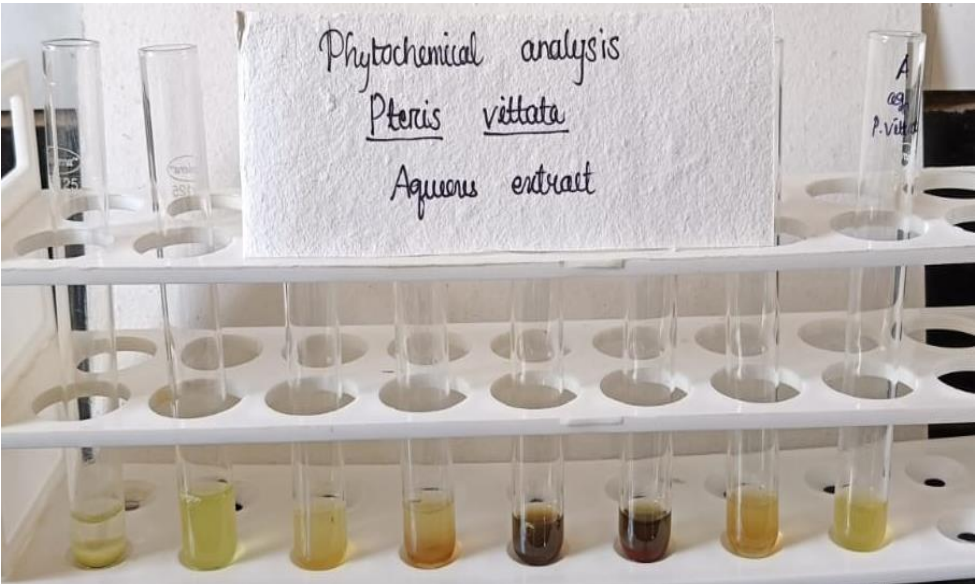


Figure 3: Detection of secondary metabolites using aqueous extract of *Pteris vittata* leaf



Figure 4: Detection of secondary metabolites using ethanolic extract of *Pteris vittata* leaf



Figure 5: Detection of secondary metabolites using acetone extract of *Pteris vittata* leaf

Conclusion

The present study was conducted with one of the pteridophyte named as *P. vittata*. Phytochemical studies showed the presence of several bioactive compounds. Thus, these findings suggest that *P. vittata* should be promoted as a medicinal plant for the enhancement of healthcare products like for aging and chronic diseases as they contained phenolic and flavonoid contents which are good source of antioxidants.

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