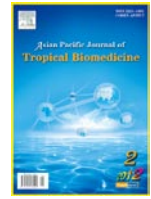




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Phytochemical studies on five medicinal ferns collected from Southern Western Ghats, Tamilnadu

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ABSTRACT

Objective: To analyze the phytochemical constituents of five medicinal ferns *Pteris biauirta* (*P. biauirta*) L., *Lygodium flexuosam* (*L. flexuosam*) (L.) Sw., *Hemionitis arifolia* (*H. arifolia*) (Burm. f.) T. Moore, *Actinopteris radiata* (*A. radiata*) (J. Koenig ex Sw.) Link and *Adiantum latifolium* (*A. latifolium*) Lam. **Methods:** The shade dried and powdered fronds (50 g) were extracted successively with 250 mL of petroleum ether, benzene, chloroform, methanol and distilled water using a Soxhlet extractor for 8 h at a temperature of 50–60°C (not exceeding the boiling point of the solvent). Phytochemical analysis of the extracts was carried out according to the standard procedures. **Results:** Among the twenty five tested extracts, twenty extracts showed the presence of flavonoids. Phenolic compounds are present in methanol extracts of all the ferns. Five extracts showed the presence of triterpinoids and catechins. Ten extracts showed the occurrence of sugars and reducing sugars. Fifteen extracts showed the presence of alkaloids. Tannins and saponins are present in eight extracts. Steroids occurred in all the twenty five extracts. Only three extracts showed the presence of anthroquinones and amino acids. **Conclusions:** From this investigation, it can be concluded that the selected five medicinal ferns contain more bioactive principles. These potential ferns could be used as bio control agnets.

1. Introduction

Pteridophytes are not infected by microbial pathogens, which may be one of the important factors for the evolutionary success of pteridophytes and the fact that they survived for more than 350 million years[1]. Considering the rich diversity of Indian medicinal plants including pteridophytes, it is expected that, the screening of plant extract for antibacterial activity may be beneficial for humans and plants diseases. The synergistic interaction among crude extracts or the active compounds may be useful in the preparation of improved herbal or drug formulations. Traditionally people used pteridophytes as medicine and anti bacterial agents. Recently there has been growing interest in exploiting the biological activities of flora and fauna owing to the natural origin,

cost effectiveness and lesser side effects[2,3]. Very less work has been done on the phytochemical and antimicrobial activity of pteridophytes, yet ethanobotanical importance of these plants have been investigated and studied by various authors. They have been found for their biological activity[4].

Later on modern biological and pharmaceutical studies were carried out on pteridophytes by different workers[5–9]. Recently many pharmaceutical innovations are developed to find and separate the secondary metabolites from the ferns for designing the new antimicrobial medicines. Paul raj *et al*[10] analysed the phytochemical and antibacterial activity of epidermal glands of the fern *Christella parasitica* (*C. parasitica*). Faridah *et al*[11] invented a modified microwave extraction system to extract the bioactive components from ferns. The antimicrobial flavonoid, rutin was isolated from the fern *Pteris vittata* (*P. vittata*)[12]. Dalli *et al*[13] characterized the antimicrobial compounds like eicosenes and heptadecanes from the fern *Pteris biauirta* (*P. biauirta*). The phyto constituents of *Selaginella* species was already analysed[14,15]. Hence the present study is focused to screen the phytochemical constituents

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of *P. biaurita* L., *Lygodium flexuosam* (*L. flexuosam*) (L.) Sw., *Hemionitis arifolia* (*H. arifolia*) (Burm.f.) T. Moore, *Actinopteris radiata* (*A. radiata*) (J. Koenig ex Sw.) Link and *Adiantum latifolium* (*A. latifolium*) Lam.

2. Materials and methods

2.1. Collection of plant materials

Healthy, disease free leaves of five ferns *P. biaurita*, *L. flexuosam*, *H. arifolia*, *A. radiata* and *A. latifolium* were collected from Kothayar and their identification was confirmed with the help of herbarium specimens in XCH (Xavier's College Herbarium), St. Xavier's college, Palayamkottai. Voucher specimens were deposited in the herbarium. The herbarium voucher numbers for the selected species were XCH 25406, XCH 25408, XCH 25409, XCH 25410 and XCH 25411.

2.2. Preparation of plant extracts

The collected plant samples were thoroughly washed, shade dried and then powdered with the help of a blender. 50 g of the powder was extracted successively with 250 mL of petroleum ether, benzene, chloroform, methanol and distilled water using a Soxhlet extractor for 8 h at a temperature of 50–60 °C (not exceeding the boiling point of the solvent). All the extracts were concentrated and preserved in airtight bottle until further use.

2.3. Phytochemical analysis

Table 1. Preliminary phytochemical screening of selected five medicinal ferns.

Compounds	Petroleum ether					Benzene					Chloroform					Methanol					Water				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Steroids	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Triterpenoids	–	–	–	–	–	+	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Reducing sugars	+	+	–	–	–	+	–	–	–	–	–	–	–	–	–	+	+	+	+	+	+	–	–	+	–
Sugars	+	+	–	–	–	+	–	–	–	–	–	–	–	–	–	+	+	+	+	+	+	–	–	+	–
Alkaloids	+	–	–	+	+	+	+	+	+	+	–	–	–	+	+	+	+	+	+	+	–	–	–	–	–
Phenolics	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	+	+	+	+	+	–	–	–	–	–
Flavonoids	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	–	–	–	–
Catechins	–	–	–	–	–	+	–	–	+	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–
Saponins	–	–	–	–	–	+	–	–	–	–	+	–	–	–	–	+	+	+	+	+	–	–	–	–	–
Tannins	–	–	–	–	–	+	–	–	–	–	+	–	–	–	–	+	+	+	+	+	–	–	–	–	–
Anthroquinones	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–
Amino acids	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–

1. *P. biaurita*, 2. *L. flexuosam*, 3. *H. arifolia*, 4. *A. radiata*, 5. *A. latifolium*.

of all the five ferns. Anthroquinones and amino acids are occurred in the petroleum ether, chloroform and methanol extracts of *P. biaurita* (Table 1).

4. Discussion

For screening the phyto chemical constituents of the five solvent extracts of the selected ferns, phytochemical analysis was carried out according to the standard methods^[16].

3. Results

Among the twenty five extracts of the selected ferns, each extract contains minimum five compounds. Methanol extracts showed maximum numbers (twelve) of the compounds (Table 1). Steroids are present in all the twenty five extracts. Triterpenoids occurred in the benzene extracts of *P. biaurita*, *A. radiata*, *A. latifolium* and methanol extracts of *P. biaurita* and *A. latifolium*. Reducing sugars and sugars are present in the petroleum ether extracts of *P. biaurita*, *L. flexuosam*, benzene extract of *P. biaurita*, methanol extracts of all the five ferns and water extract of *P. biaurita* and *A. radiata*. Alkaloids are present in the petroleum ether extracts of *P. biaurita*, *A. radiata*, *A. latifolium*, benzene and methanol extracts of all the five ferns and chloroform extracts of *P. biaurita* and *A. latifolium*. Phenolic compounds are present only in the methanol extracts of the selected ferns. Flavonoids are occurred in petroleum ether, benzene, chloroform and methanol extracts of the five ferns and water extract of *P. biaurita*. Catechins are present in the benzene extracts of *P. biaurita*, *A. radiata*, *A. latifolium* and methanol extracts of *P. biaurita* and *A. latifolium*. Saponins and tannins are present in the benzene extract of *P. biaurita*, chloroform extracts of *P. biaurita*, *L. flexuosam* and methanol extracts

Pteridophytes show medicinal utility and many of them are being used medicinally from ancient time. The tribal communities, ethnic groups and folklore throughout the world are utilizing plant parts like rhizome, stem, fronds, pinnae and spores in various ways for the treatment of various ailments since ancient time^[17]. The medicinal

values are caused by presence of chemical compounds in the ferns. Hence this study is focused to analyze the compounds which are present in some Indian medicinal ferns with five solvent extracts. Maximum numbers (twelve) of the compounds are screened in methanol extracts of all the ferns. The numbers of contribution about the taxonomy, ecology and distribution of Pteridophytes have been published from time to time but enough attention has not been paid towards their medicinal useful aspects[18]. The alkaloids and flavonoids are present in all the extracts of the selected ferns except water extract. Alkaloids and flavonoids are the source of antimicrobial activities. Tannins may have the potential values as cytotoxic agents[19]. Tannins are present in the methanol extracts of all the selected ferns. Hence the selected ferns may be used as anti-cancer agents. Phenolic compounds are the important source for antimicrobial and insecticidal activities. The methanol extracts of the five ferns showed the presence of phenolic compounds. Saponins have been implicated as bioactive antibacterial agents[20]. Saponins are present in the methanol extracts of all the selected ferns. Finally the result of the present study clearly shows that, due to the presence of maximum numbers of the compounds, the selected ferns may be used in anti-microbial and anti-cancer agents. This study also leads to the further research in the way of isolation and identification of the active compound from the selected ferns. It will help to produce new medicines with less side effect, less costly affordable and more effective in the treatment of various infectious diseases in future.

Conflict of interest statement

We declare that we have no conflict of interest.

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