EUROPEAN JOURNAL OF BIOMEDICAL AND PHARMACEUTICAL SCIENCES
http://www.ejbps.com

ISSN 2349-8870
Volume: 4
Issue: 12
571-575
Year: 2017

PHYTOCHEMICAL PROFILES OF *ADIANTUM LATIFOLIUM* LAM. *ANGIOPTERIS EVECTA* (FORST) HOFFM. AND *MARATTIA FRAXINEA* SM

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Article Received on 05/10/2017 **Article Revised on 25/10/2017** **Article Accepted on 15/11/2017**

ABSTRACTS

Objectives: The present study was aimed to reveal the qualitative phytochemical profile of *Adiantum latifolium* Lam. whole plants, stem and leaves extracts of *Angiopteris evecta* (Forst) Hoffm. and *Marattia fraxinea* Sm. **Methods:** The powdered samples of *A. latifolium*, *A. evecta* and *M. fraxinea* were extracted with various solvents viz., petroleum ether, chloroform, acetone and ethanol using soxhlet apparatus with 1:6 ratio (w/v). The phytochemical constituents of selected ferns were analysed by using Harborne method. Results: The number of phytoconstituents occurrence in the studied extracts of *Adiantum latifolium* were as follows chloroform (8/10) > petroleum ether (6/10) = acetone = ethanol. Flavonoids, tannins, terpenoids, phenols, cardiac glycosides and steroids were present in all the tested extracts of *A. latifolium*. The number of phytoconstituents occurrence in the studied extracts of *Angiopteris evecta* leaves and stem were as follows chloroform (8/10) > petroleum ether > acetone = ethanol. All the studied leaves and stem extracts of *Angiopteris evecta* demonstrated the presence of steroids, phenols, terpenoids, tannins and flavonoids. The number of phytoconstituents present in the studied extracts of *Marattia fraxinea* leaves were as follows chloroform > petroleum ether > acetone = ethanol. In *Marattia fraxinea* stem, maximum metabolites were observed in the chloroform extracts followed by petroleum ether = ethanol. In the leaves and stem extracts of *Marattia fraxinea*, flavonoids, tannins, terpenoids, phenols and steroids were commonly present in all the screened extracts. In the present study also flavonoids, alkaloids, phenols, terpenoids, saponins, tannins, steroids, cardiac glycosides and carbohydrates were observed in the studied ferns with varied frequency. **Conclusion:** The phytochemical results suggest that chloroform extracts of *A. latifoloium*, *A. evecta* and *M. fraxinea* may possess wound healing, anti-diuretic, anti-parasitic, anti-inflammatory, antimicrobial cytotoxic, anti-neoplastic, insecticidal, anti-diabetic, anti-feedent and antioxidant activity. The chloroform extracts of the studied ferns may act as alternate natural medicine in the pharmaceutical industries.

KEYWORDS: Phytoprofile; Secondary metabolites; ferns.

INTRODUCTION

Pteridophytes show medicinal utility and many of them are being used as medicine 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.[1] Sukumaran et al.[2] identified the phytoprofile of *Tectaria zeylanica* from Southern Western Ghats. Britto et al.[3] revealed the metabolites of *Pteris biaurita*, *Lygodium flexuosam*, *Hemionitis arifolia*, *Actinopteris radiata* and *Adiantum latifolium*. Gracelin et al.[4] reported the phyto-constituents and antibacterial potentials of *Pteris confusa*, *Angiopteris evecta*, *Adiantum caudatum*, *Lygodium microphyllum* and *Pteris argyraea*. Babu et al.[5] studied the phytochemical screening of *Adiantum latifolium* leaves ethanolic extracts. Mithraja et al.[6] studied the inter-specific variation among *Christella* and *Adiantum* species using phytochemical methods. Revathi et al.[7] evaluated the phytochemical profile of leaves and petiole extracts of *Marsilea minuta*. Britto et al.[8] studied the quantitative and qualitative analysis of phytochemicals in *Marsilea minuta*. Coisen et al.,[9] evaluated the phytochemical evaluation of some *Salvia* species from Romanian flora. Awadhesh et al.[10] evaluated the phytochemical analysis of *Adiantum* and *Pteris*. Toji et al.[11] evaluated the phytochemical analysis of *Adiantum raddianum*. Kalpana devi et al.[12] determined the phytoprofile of *Actinopeteris radiata*, *Drynaria quercifolia*, *Dryopetris cochleata* and *Pitrogramma calomelanos*. Johnson et al.[13] studied the preliminary phytochemical analysis on *Asplenium aethiopicum*.

Bahadori et al.[14] studied the metabolites profiles of selected ferns from Iran. Kalpana devi et al.,[15] reported the secondary metabolites occurrence in *Actinopteris radiata*, *Acrostichum aurem* and *Hemionitis arifolia*. Awe and Amobi[16] determined the phytochemical profiles of *Pteridium aquilinum*. Manisha[17] studied the qualitative and quantitative phytochemical analysis of three *Bolbitis* species. Rukmini et al.[18] illustrated the phytoprofiles of *Hemionitis arifolia* from Tirumala Hills.

Mismawati et al.[19] revealed the metabolites profile of the *Angiopteris evecta* leaves from East Kalimattan. Britto et al.[3] observed the presence of alkaloids, flavonoids, steroids, triterpenoids, catechins, saponins, tannins and phenolics in *A. latifolium* from Kothayar. Mithraja et al.[6] analysed the phytoconstituents of *A. latifolium* from Kakachi, Tirunelveli Hills and confirmed the presence of steroids, tannins, phenols, carbohydrates. Babu[20] evaluated the phytoconstituents of *A. latifolium* leaves extracts from Marthandam, Kanyakumari District and reported the occurrence of flavonoids, triterpenes, saponins and tannins in aqueous extracts using cold extraction. But there is no report on the hot whole plants extracts of *Adiantum latifolium* from marthandam. Molla et al.[21] revealed the phytoprofile of *Angiopteris evecta* root methanolic extracts from Bangladesh and Mismawati et al.[19] reported the metabolites profiles of *Angiopteris evecta* leaves methanolic extracts from Indonesia and Britto et al.[22] explored the phytoprofile of *Angiopteris evecta* leaves extract from Kothayar. But there is no report on the stem extracts of *Angiopteris evecta*. There is no previous report/ literature in *Marattia fraxinea*. With this knowledge the present study was aimed to reveal the qualitative phytochemical profile of *Adiantum latifolium* Lam. whole plants, stem and leaves extracts of *Angiopteris evecta* (Forst) Hoffm. and *Marattia fraxinea* Sm.

MATERIALS AND METHODS

Among the three plants, *Adiantum latifolium* Lam. was collected from the Rubber field of Unnamalaikadai, Kanyakumari, Tamil Nadu, India, while the other two plants namely *Angiopteris evecta* (Forst) Hoffm. and *Marattia fraxinea* Sm. were collected from the Kodaikanal Botanical garden. The plants were identified taxonomically and authenticated by Dr. M. Johnson, Assistant Professor, St. Xavier's College, Palayamkottai and the voucher specimen was deposited in the Herbarium of Nesamony Memorial Christian College, Marthandam.

Preparation of plant extracts

Fresh and healthily plant parts of *Adiantum latifolium* Lam., *Angiopteris evecta* Forst Hoff. and *Marattia fraxinea* Sm. were collected, washed thoroughly under running tap water and then rinsed in distilled water. The plant materials were shade dried for 15 days at room temperature. The dried plant samples were crushed into fine powder and stored in airtight bottles. The powdered samples were extracted with various solvents viz., petroleum ether, chloroform, acetone and ethanol using soxhlet apparatus with 1:6 ratio (w/v). The extraction was collected in petriplates and the solvents were evaporated to dryness, the residue left over was transferred to a small vial and stored at 4ºC in refrigerator for further analysis. The phytochemical profiles of selected ferns were analysed by using Harborne method.[23] For the analysis, ten metabolites namely alkaloids, cardiac glycosides, flavonoids, steroids, saponins, tannins, anthroquinones, coumarins, terpenoids and phenolic compounds were selected and the tests were repeated three times to confirm the presence/absence of metabolites present in the selected ferns.

RESULTS

The preliminary phytochemical analysis results of *Adiantum latifolium*, *Angiopteris evecta* and *Marattia fraxinea* were recorded and tabulated in Table 1. The number of phytoconstituents occurrence in the studied extracts of *Adiantum latifolium* were as follows chloroform (8/10) > petroleum ether (6/10) > acetone = ethanol. Flavonoids, tannins, terpenoids, phenols, cardiac glycosides and steroids were present in all the tested extracts of *A. latifolium*. Alkaloids and saponins were observed only in chloroform extracts of *A. latifolium*. Anthroquinone and coumarin were totally absent in all the studied extracts of *A. latifolium*.

The number of phytoconstituents occurrence in the studied extracts of *Angiopteris evecta* leaves and stem were as follows chloroform (8/10) > petroleum ether > acetone = ethanol. All the studied leaves and stem extracts of *Angiopteris evecta* demonstrated the presence of steroids, phenols, terpenoids, tannins and flavonoids. Anthroquinone and coumarin were absent in all the screened extracts of *Angiopteris evecta* leaves and stem. Saponins showed its presence only in the petroleum ether and chloroform extracts of *Angiopteris evecta* leaves and stem. Alkaloids showed its occurrence only in the chloroform extracts of *Angiopteris evecta* leaves and stem. In the leaves extracts of *Angiopteris evecta*, cardiac glycosides was observed only in the petroleum ether and chloroform extracts whereas in the stem extracts of *Angiopteris evecta*, cardiac glycoside was present in all the tested extracts.

The number of phytoconstituents present in the studied extracts of *Marattia fraxinea* leaves were as follows chloroform > petroleum ether > acetone = ethanol. In *Marattia fraxinea* stem, maximum metabolites were observed in the chloroform extracts followed by petroleum ether > acetone = ethanol. In the leaves and stem extracts of *Marattia fraxinea*, flavonoids, tannins, terpenoids, phenols and steroids were commonly present in all the screened extracts. The anthroquinone and coumarin were absent in all the tested leaves extracts of *Marattia fraxinea*. Alkaloids were observed only in the chloroform extracts of leaves and stem extracts of *Marattia fraxinea*. Saponins showed its limited presence

in the petroleum ether and chloroform extracts of *Marattia fraxinea* leaves and stem. Cardiac glycosides were showed its confined existence only in the chloroform extracts of *Marattia fraxinea* leaves.

Table 1: Phytochemical screening of *Adiantum latifolium, Angiopteris evecta* and *Marattia fraxinea*

Metabolites	*A. latifolium*				*Angiopteris evecta*								*Marattia fraxinea*								Total
	Whole plants				Leaves				Stem				Leaves				Stem				
	P	C	A	E	P	C	A	E	P	C	A	E	P	C	A	E	P	C	A	E	
Alkaloids	-	+	-	-	-	+	-	-	-	+	-	-	-	+	-	-	-	+	-	-	5
Cardiac glycosides	+	+	+	+	+	+	-	-	+	+	+	+	-	+	-	-	-	-	-	-	11
Flavonoids	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	20
Saponin	-	+	-	-	+	+	-	-	+	+	-	-	+	+	-	-	+	+	-	-	9
Tannin	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	20
Anthroquinone	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Coumarins	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Terpenoids	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	20
Phenolics	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	20
Steroids	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	20
Total	6	8	6	6	7	8	5	5	7	8	6	6	6	8	5	5	6	7	5	5	125

Note: P - Petroleum ether; C - Chloroform; A – Acetone; E – Ethanol; (+) – presence; (-) – absence

DISCUSSION

Plants produce secondary metabolites when the environmental condition is not favour for themselves.[24] The results of the present study confirmed that chloroform extracts of the studied ferns showed more number of metabolites than other studied extracts. Similar to present study results Majaz et al.[25] also revealed more number of metabolites from chloroform extracts of *Kalanchoe pinnata* roots. Flavonoids, alkaloids, polyphenols, terpenoids, quinines, steroids, polysaccharides etc are the secondary metabolites produced by the plants at various adverse environmental conditions.[26] In the present study also flavonoids, alkaloids, phenols, terpenoids, saponins, tannins, steroids and cardiac glycosides were observed in the studied ferns with varied frequency.

Britto et al.[3] reported only three metabolites (alkaloids, flavonoids, steroids) from the chloroform extracts of *A. latifolium* from Kothayar but in the present study eight metabolites occurrence were recorded in the chloroform extracts of *A. latifolium.* Similarly Britto et al.[3] obtained three metabolites viz., saponins, tannins and phenolics in the methanolic extracts of *A. latifolium* but in the present study flavonoids, polyphenols, terpenoids, steroids, cardiac glycosides and tannins were present in the ethanolic extracts of *A. latifolium.* Mithraja et al.[6] confirmed the presence of steroids in petroleum ether; tannins in acetone, chloroform and water; phenols in acetone, benzene, chloroform, water, ethanol and petroleum ether; carbohydrates in acetone, chloroform water, ethanol and petroleum ether. But in the present study cardiac glycosides, tannins, flavonoids, terpenoids, phenolics and steroids were confirmed their existence in ethanolic, acetone and petroleum ether extracts of *A. latifolium.*

Babu[20] reported the occurrence of flavonoids in petroleum ether, benzene, chloroform, methanol and water extract; triterpenes in methanol; saponins in methanol and water; tannins in aqueous extract using cold extraction. But in the present study eight metabolites were observed in the chloroform extracts of *A. latifolium.*

Of these secondary metabolites about 10 to 25% are alkaloids. Alkaloids are chemical constituents that acts on the nervous system of the human body and used for analgestic, antisepasmodic and bacterial effects.[27,28]

Flavonoids are water soluble free radical scavengers that protect the cells from oxidative cell damage.[29] Flavonoids are considered as nature's biological response modifiers because they have the ability to modify reactions in our body. They show anti-allergic, anti-inflammatory antimicrobial and anticancer activity.[30,37] Steroids and saponins are the sub- groups of triterpenoids. Saponins possess antimicrobial activity (Mandal *et al.,* 2005) anti- inflammatory activity.[38]

Phenol and phenolic compounds are greatly used in skin infections and wound healing activities and hemolytic effects. They posses various biopotency viz., anti-inflammatory, anti-oxidant, anti-microbial, insecticidal, anti-diabetic, anti-feedent, immune enhancers, anti-clotting and hormone modulators.[39,42] Saponins have been implicated as bioactive antibacterial agents of plants.[43,44] Plant steroids are known for their cardio tonic activities. They possess insecticidal and anti-microbial properties. Steroids are also used in nutrition, herbal medicine and cosmetics.

The major role of tannin in plant is protection from predation. Tannins are located in the vacuoles / surface wax of pants. These storage sites are active against plant predators, Tannins are known to possess wound healing, anti-diuretic, anti-parasitic, anti-inflammatory, antimicrobial cytotoxic, antineoplastic and antioxidant activity.[45,50]

The chloroform extracts showed the occurrence of flavonoids, alkaloids, phenols, terpenoids, saponins, tannins, steroids and cardiac glycosides in the studied ferns. The phytochemical results suggest that chloroform extracts of *A. latifoloium*, *A. evecta* and *M. fraxinea* may possess wound healing, anti-diuretic, anti-parasitic, anti-inflammatory, antimicrobial, cytotoxic, anti-neoplastic, insecticidal, anti-diabetic, anti-feedent and antioxidant activity. The chloroform extracts of the studied ferns may act as alternate natural medicine in the pharmaceutical industries.

CONCLUSION

The present study reveals that among the four solvents employed chloroform showed more number of metabolites. The results of the present study helped us to identify the medicinal properties of the studied three ferns. The results clearly confirmed that three ferns possess rich medicinal properties. Further studies are required to isolate the active principles responsible for the biological properties.

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