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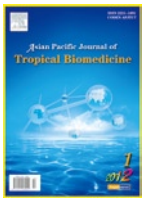

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Bioactive constituents of oak leaf fern-*Tectaria zeylanica* (Houtt.) Sledge from southern Western Ghats

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ABSTRACT

Objective: To identify the phytoconstituents present in the fronds of *Tectaria zeylanica*. **Methods:** Screening of phytochemicals was done by using the standard methods given by Harborne. **Results:** Phytochemical screening of the fronds of *Tectaria zeylanica* confirmed the presence of various derivatives such as phenols, saponins, steroids, tannins, xanthoproteins, coumarins and carbohydrates. **Conclusions:** The present observations suggest a possibility to establish high yielding plantlets by *in vitro* culture for the production of medicinally important bioactive compounds against human pathogenic microorganisms.

1. Introduction

Ferns and their allied plants have little economic significance to humankind as compared to other groups, especially Angiosperms; hence these are poorly understood, overlooked or often neglected by the society. None the less, being the major constituent of biodiversity their role in the system of nature cannot be overlooked or neglected in the global changing environmental scenario[1]. Despite the large number of ferns and their allied species a considerable percentage of them are rare and threatened. With increasing utilization of land and natural resources, it is feared that many of these threatened taxa will become yet rarer, more vulnerable and endangered, and in several cases may finally become extinct, as any disturbance or imbalance in their narrowly confined ecosystems is liable to lead to their extermination[2].

Tectaria zeylanica (*T. zeylanica*) (Houtt.) is a rare fern belonging to the family Dryopteridaceae. The species is distributed in Sri Lanka, South India and Southern China, though it has a restricted distribution. In India it is distributed only in some isolated patches of Kanyakumari and Tirunelveli Hills of southern Western Ghats, being rediscovered after a lapse of about 140 years of its first collection[4-9]. So far there are no studies available pertaining to this species. The pharmacological importance and phytochemistry of this species is unknown. In view of this fact, the present study was aimed to analyze the phytochemicals present in the fronds of *T. zeylanica*.

2. Materials and methods

2.1. Collection and authorization of plant material

During the floristic survey of Kanyakumari wildlife sanctuary the species were collected from the foothills of Chithagiri Thirucharanathumalai, a fragmented landscape of southern western Ghats. The collected specimen was identified and authenticated by a renowned pteridologist Dr. K Paulraj, Head, Department of Botany, Nesamony Memorial Christian College, Marthandam, Kanyakumari district, Tamilnadu, India.

2.2. Phytochemical screening of fronds

The shade dried fronds of *T. zeylanica* were successively extracted in various solvents such as acetone, benzene, chloroform, ethanol, petroleum ether and distilled water by using Soxhlet apparatus. The extracts were further concentrated using vacuum evaporator. All the extracts were subjected to preliminary phytochemial estimation as per the methods given by Harborne[10].

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3. Results

Table 1 showed the findings of preliminary phytochemical screening of the fronds of *T. zeylanica*. Six different extracts (acetone, benzene, chloroform, ethanol, petroleum ether and distilled water) were screened for the presence or absence of twelve different organic chemical compounds. Alkaloids, flavonoids, proteins, quinones and carboxylic acids did not show any positive result in all the six extracts. None of the chemicals screened were present in all the extracts. Phenolic compounds are present in four extracts (acetone, benzene, ethanol, distilled water), saponin, tannin, coumarin and carbohydrates showed positive result for their presence in three extracts, whereas steroids gave positive results in two extracts and xanthoproteins were present only in aqueous extract.

Of the six extracts studied, water yielded maximum number of compounds (phenols, steroids, tannins, xanthoproteins and coumarins), followed by benzene and chloroform extracts showing the presence of four compounds. Ethanol and acetone gave three and two compounds, respectively, while petroleum ether extract showed the positive result to saponins alone. Carbohydrates were present in benzene, chloroform and methanol extracts.

Table 1
Bioactive constituents of *T. zeylanica*.

Sl. No.	Phytoconstituents	Name of the extracts						
		Acetone	Benzene	Chloroform	Ethanol	Petroleum ether	Distilled H_2O	Number of extracts with the chemical compounds
1	Alkaloids	−	−	−	−	−	−	−
2	Phenols	+	+	−	+	−	+	4
3	Flavonoids	−	−	−	−	−	−	−
4	Saponins	−	+	+	−	+	−	3
5	Protein	−	−	−	−	−	−	−
6	Quinone	−	−	−	−	−	−	−
7	Steroids	−	−	+	−	−	+	2
8	Tannins	+	−	−	+	−	+	3
9	Xanthoproteins	−	−	−	−	−	+	1
10	Carboxylic acids	−	−	−	−	−	−	−
11	Coumarins	−	+	+	−	−	+	3
12	Carbohydrates	−	+	+	+	−	−	3
No. of compounds present in each extract		2	4	4	3	1	5	

+: indicates the presence of particular compound; −: indicates the absence of particular compound.

4. Discussion

Plants are rich source of phytochemical constituents for developing antimicrobial drugs[11-15]. Phytochemical screening of *T. zeylanica* shows that water is the good solvent for extracting phytochemicals and reported maximum number of compounds, when compared to other solvents. The present findings corroborated the report of Mithraja[16] on species diversity, phytochemistry and bioactivity of the selected pteridophytes of Kattakada village, and confirmed that water is the most excellent solvent extracting phytochemicals from *Adiantum lunulatum*. Steroids and saponins are the sub-groups of triterpenoids. Recently Paulraj *et al*[17] reported the presence of triterpenoids in the epidermal glands of six thelypteroid ferns from south India. Presence of triterpenoids has also been reported in *Blechnum* species[18,19].

The bioactive constituents such as phenols, alkaloids, flavonoids, steroids and tannins, *etc.*, were responsible for bioactivity. Seven phenolic compounds, eriodictyol-8-C-β-D-glucopyranoside, 6,7-dihydroxy-1,1-dimethylisochromane, gallic acid, ellagic acid, 2,3-hexahydroxydiphenoyl-D-glucose, (−)-epicatechin, (−)-epigallocatechin, (+)-gallocatechin and 3,5-di-O-caffeoylquinate were isolated from the leaves of *Tectaria subtriphylla*[20]. Presence of phenolic compounds in acetone, benzene, ethanol and water extracts in the presently studied species depicted the intraspecific similarity within the genus. Thus morphological, chemical and physiological diversities are interrelated and all are controlled by genetic diversity[17].

Several species of *Tectaria* are being used as ethnomedicine to cure various ailments. Rhizome decoction of *Tectaria coadunata* is given to children in stomachache by the local people of Kumaun Himalaya[21], Darjeeling district[22,23], Amarkantak[24], Ratnagiri district of Maharashtra[25] and Nepal[26]; the fronds of this species possess antibacterial activity[27]. The plant powder of the species is used for cough, cold and fever[28]. Decoction of the leaves is given to asthma and bronchitis[29]. It is also used as green vegetable in Terai, Nepal[30] and Amarkanthak, Madhya Pradesh[24]. The whole plant of *Tectaria polymorpha* and the rhizome of *Tectaria wightii* are anthelmintic[22,31]. *Tectaria dubia* is used to cure asthma, bronchitis and dysentery[32]. Root paste of *Tectaria vasta* is used to treat abdominal tumors among the Chakma tribes of the hill districts of Bangladesh[33]. Based on the above literature, it is concluded that the species of *Tectaria* possess various bioactive compounds including the presently studied species which may be beneficial in the healing of various pathogenic infections.

The present study confirmed that the fronds of oak leaf fern, *T. zeylanica* have several bioactive compounds and such rare plant should be conserved in nature. Since the species is confined to the sacred forests on the foot hills of southern western Ghats, it should be conserved under the control of the traditional society. Commercial exploitation of this species may lead to its extinction in nature. Thus further study should be concentrated on *in vitro* multiplication for

large scale production of secondary metabolites and also to conserve the species for environmental sustainability.

Conflict of interest statement

We declare that we have no conflict of interest.

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