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Phytopharmacological characterization of different extracts and fractions of *Cyclea peltata*

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ABSTRACT

Cyclea peltata is a shrub belongs to Menispermiaceae family and is commonly known as “Pedal” or “Pada thalli”. The plant has been used since ancient times in traditional medicine as a healing herb for the treatment of various ailments such as skin infections, wounds, antipyretic, diuretic, diabetes, asthma, jaundice and snakebite poisoning. The objective of the present study was to characterize the active phytochemical constituents present in the aqueous, methanolic and n-hexane, dichloromethane, n-butanol, water fractions of methanolic extracts of *C. peltata*. To analyse the potent bioactive compounds, present in the extracts and fractions, Fourier Transform Infrared Spectroscopy was used. The qualitative phytochemical screening unveiled the presence of steroids, alkaloids, glycosides, flavonoids, terpenoids, saponins in aqueous extract and alkaloids, phenols, tannins, flavonoids, terpenoids, saponins in methanolic extract. The fractions of *C. peltata* showed the presence of alkaloids, phenols, tannins, flavonoids, terpenoids, saponins. The Infrared Spectroscopy profiling showed the presence of alcohols, phenols, amines, carboxylic acids, aldehydes, ketones, alkenes, alkanes and aromatic compounds. From the study, it is concluded that the bioactive compounds present in the extracts and fractions of *C. peltata* was alkaloids, phenols, flavonoids and terpenoids which is responsible for the diverse pharmacological properties.

Keywords: *Cyclea Peltata*, Extracts And Fractions, Phytochemicals, FTIR.

INTRODUCTION

Medicinal plants are considered as armoury of remedies to prevent and cure various ailments in all cultures of the world from ancient times [1]. Plants have been traditionally regarded as a rich source of bioactive phytochemicals or bio nutrients, which are naturally occurring chemical compounds found in medicinal plants, include tannins, alkaloids, carbohydrates, terpenoids, steroids and flavonoids [2]. These molecules are known as secondary plant metabolites and their medicinal significance has piqued researchers' curiosity. Despite considerable improvements in modern medicine, the creation of novel medications derived from natural products is still a priority.

Cyclea peltata also known as “Pedal”, “Pada thalli” in Kerala belonged to Menispermiaceae family is a much branched, slender twining climbing shrub with tuberous roots, peltate leaves, greenish yellow flowers and drupaceous fruits [3,4]. It can be found in Sri Lanka, the Andaman and Nicobar Islands, Eastern and Southern India, particularly in the Western Ghats. The National Medical Plant Board of India had designated it as "therapeutic plant species in high trade sourced from tropical woods" due to its significant medicinal value.

The plant contains alkaloids such as cycle nine, berberine, hayatinin, hayatinin and hayatin in leaves and bis benzyl is quinoline alkaloids, cyclopentane, ciclafrine, cycleacuine, cycle Norine and cycleahomine chloride in the roots [5]. It is widely used in the treatment of cough, fever, kidney disorder, urinary disorder and snake poisoning and leaves were used for antipyretic, diuretic and antidandruff treatment [6]. In Ayurveda jaundice, stomach-ache, fever, asthma, Type 2 diabetics and nephrolithiasis are treated with tuberous roots of the plant. Powdered roots of this plant are used for the treatment of diabetes, toothache; decoction of the roots and leaves used for treating malaria and asthma [7].

MATERIALS AND METHODS

Plant material

The aerial parts of *C. peltata* was collected locally from Mannuthy, shade dried and pulverized using an electric pulverizer to a coarse powdered material.

Aqueous (AE) and methanolic (ME) extraction of *C. peltata*

The aqueous extract was extracted by placing the packed plant material in a beaker containing distilled water using hot aqueous extraction process. The coarse powdered plant material was extracted using methanol in Soxhlet extraction apparatus. Both the solvents were condensed using rotary vacuum evaporator under controlled pressure and temperature at 40°C. The aqueous and methanolic extracts were dried at room temperature. The yield of the extract was calculated with reference to the initial dry material and stored in an airtight container under refrigeration until further use.

Fractionation of methanolic extract of *C. peltata*

The methanolic extract was fractionated using different solvents n-hexane (HF), dichloromethane (DF), n-butanol (BF) and water (WF) in an order of increasing polarity. 25 g of methanolic extract was dissolved in n- hexane solvent (100 mL) in a separating funnel and the soluble fraction was removed. The insoluble portion was dissolved in dichloromethane (100 mL) and its soluble fraction was removed. The leftover residue was mixed with n-butanol (50 mL) and water (50 mL) thoroughly and soluble part in each solvent were collected and evaluated for dryness. The yield of the fractions was calculated and kept in an airtight container under refrigeration till further use [8].

Phytochemical screening

The qualitative phytochemical screening (Table 1) was conducted [9].

Table 1: Qualitative phytochemical tests

S. No	PHYTOCHEMICALS	TEST	INFERENCE
1	Steroids	Salkowski's test	Red colour
		Liebermann Burchardt test	Reddish ring at the confluence of two layers
2	Alkaloids	Dragendorff's test	Reddish brown precipitate
		Mayer's test	Cream coloured precipitate
		Wagner's test	Reddish brown colour
		Hager's test	Yellow precipitate
3	Glycosides	Sodium hydroxide test	Yellow colour
		Benedict test	Brown or red Precipitate
4	Phenolic compounds	Ferric chloride test	Bluish black colour
5	Tannins	Ferric chloride test	Brownish green or blue-black colour`
		Gelatin test	White precipitate
6	Flavonoids	Ferric chloride test	Green colour
		Lead acetate test	Yellow precipitate
7	Triterpenes	Salkowski's test	Yellow colour in lower layer
		Liebermann Burchardt test	Deep red ring at the junction of two layers
8	Diterpenes		Green colour
9	Saponins	Foam test	Persistent foam for ten minutes

FTIR characterization of extracts and fractions of *C. peltata*

The Fourier Transform Infrared Spectroscopy (FTIR) was used to identify the types of chemical bonds present in the phytochemicals by measuring the absorbance which is a time-saving method to characterize the functional groups. To identify the structurally similar molecular compounds, present in *C. peltata* extracts and fractions ATR-FTIR (Attenuated Total Reflectance - Fourier transform infrared) analysis was performed. A Perkin- Elmer spectrum two FTIR spectrometer with attenuated total reflectance was used for FTIR analysis. The sampling station was equipped with an overhead ATR accessory. The ATR diamond crystal was carefully cleaned with pure isopropanol and a small quantity of the sample was placed carefully on the diamond crystal surface to cover the ATR diamond window in order to focus the laser beam. Each spectrum was recorded as absorbance under 60 N.

RESULTS

Plant extraction

The yield obtained from aqueous, methanolic extracts and fractions of *C. peltata* was presented in table 2.

Table 2: Yield of extracts and fractions of *C. peltate*

Extracts and Fractions	Yield (%)
Aqueous	6.5
Methanolic	13.8
n-hexane	21.2
Dichloromethane	18
n-butanol	16.8
Water	18.3

Phytochemical screening

The qualitative phytochemical screening of aqueous, methanolic extracts and fractions of *C. peltata* revealed the presence of various active phytoconstituents (Table 3).

Table 3: Results of Qualitative phytochemical analysis of *C. peltata*

PHYTO-CONSTITUENTS	AE	ME	HF	DF	BF	WF
Steroids	+	-	-	-	-	-
Alkaloids	+	+	+	-	+	+
Glycosides	+	-	-	-	-	-
Phenols	-	+	+	-	+	-
Tannins	-	+	-	+	+	-
Flavonoids	+	+	+	-	+	+
Diterpenes	+	+	+	+	+	+
Triterpenes	+	+	+	-	+	+
Saponins	+	+	+	-	+	+

FTIR characterization of extracts and fractions of *C. peltata*

The most similar molecular compounds identified by comparing the spectra of the extract and fractions using FTIR and the FLUKA library. The absorption spectrum profile for aqueous extract (AE), methanolic extract (ME), n-hexane fraction (HF), dichloromethane fraction (DF), n-butanol fraction (BF) and water fraction (WF) of *C. peltata* (Figure 3-8).

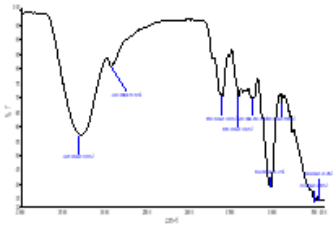

Figure 1. FTIR analysis of AE

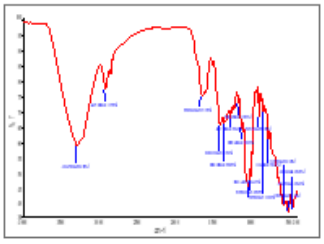

Figure 2. FTIR analysis of ME

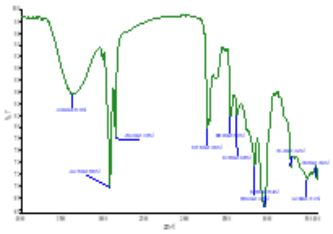

Figure 3. FTIR analysis of HF

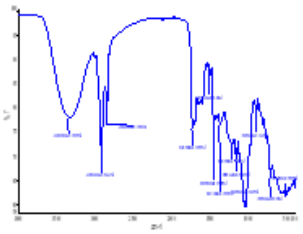

Figure 4. FTIR analysis of DF

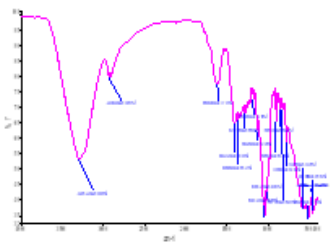

Figure 5. FTIR analysis of BF

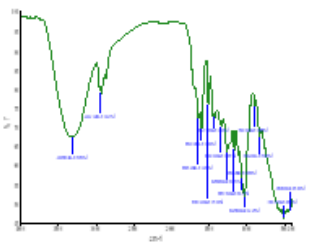

Figure 6. FTIR analysis of WF

FTIR spectral peak values and the corresponding functional groups were presented (Table 4). The spectrum range gave broad peak at 3374.99, 3345.51, 3298.96 cm-1 indicate O-H and N-H stretching, 2932.72, 2918.34, 2852.73 cm-1 indicate –OH stretching, 1736.10, 1734.12 cm-1 indicate –C=O stretching, 1645.99, 1605.83 cm-1 indicate –C-H stretching, 1515.70 cm-1 indicate -C=C- stretching, 1456.46, 1427.55, 1339.53 cm-1 indicate –C-H bending and 1266.46 and 1163.97 cm-1 indicates –C-O stitching. The FTIR spectrum confirmed the presence of alcohols, amines, carboxylic acids, phenols, alkanes, alkenes, aldehydes, ketones and aromatic compounds.

Table 4: Similar compounds from the absorption spectra of *C. peltata*

Absorption spectra (cm-1)	Type of compounds
3374.99, 3345.51, 3298.96	Alcohols, Phenols, Amines
2932.72, 2918.34, 2852.73	Carboxylic acids
1736.10,1734.12	Aldehydes, Ketones
1645.99, 1605.83	Alkenes
1515.70	Aromatic compounds
1456.46, 1427.55, 1339.53	Alkanes
1266.46, 1163.97	Phenols

DISCUSSION

The pharmacological action of various drugs and its therapeutic uses are because of their active bio constituents such as phenols, tannins, flavonoids, alkaloids and several other plant metabolites. Therefore, the preliminary phytochemical screening and characterization of crude extracts are considered marked importance as they possess varied composition of secondary metabolites. In the current study, the various phytoconstituents present in the different extracts and fractions of *C. peltata* was investigated for its phytopharmacological properties.

The yield obtained from aqueous, methanolic extract and fractions (HF, DF, BF, WF) of *C. peltata* was 6.5, 13.8, 21.2, 18, 16.8 and 18.3 per cent respectively. Similar yield from the aqueous, methanolic and water fraction was reported [10-12]. Phytochemical constituents revealed the presence of alkaloids, flavonoids, steroids, terpenoids, saponins in aqueous extract and alkaloids, phenols, tannins, flavonoids, terpenoids, saponins in methanolic extract. The fractions showed the presence of alkaloids, phenols, tannins, flavonoids, terpenoids and saponins. These findings are consistent with the earlier reports [13,14]. The presence of these phytochemicals in *C. peltata* reported to have antimicrobial [15]. diuretic [16]. antioxidant [17]. anticancer [18]. antidiabetic [19]. antifungal [20]. antitoxin [21]. anti-leukemic [22]. properties.

Fourier Transform Infrared Spectroscopy (FTIR) is a reliable and sensitive analytical method used to identify the active chemical constituents and ascertain its structural compounds [23,24]. In this study, the FTIR analysis revealed the presence of alkaloids due to N-H stretching, polyphenols and flavonoids due to O-H stretching, terpenes due to C-H group [25]. The functional groups alcohols, amines, phenols, carboxylic acids, aldehydes, ketones, alkanes, alkenes, aromatics compounds were the secondary metabolites present in this plant and confirmed by FTIR spectroscopy. The presence of these molecular groups could be responsible for the numerous pharmacological properties of *Cyclea peltata*.

In conclusion, the phytochemical screening and FTIR characterization of the whole plant extract of *Cyclea peltata* revealed the existence of alkaloid, phenol, flavonoid and terpenoid, which can be separated and subsequently screened for various biological activities depending on

their medicinal purposes. Further research using other analytical methods such as NMR and mass spectrophotometer will be required to determine the structural analysis of these compounds.

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Conflict of Interest

None declared.

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None declared.

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