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Phytochemical and FT-IR spectral analysis of *Cyclea peltata* (Lamk.) hook an endemic medicinal plant

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Abstract
The present investigation was focused on the preliminary phytochemical and Fourier Transform Infrared Spectral analysis of *Cyclea peltata* (Lamk.) Hook. The aqueous and organic solvent extracts (ethanol, Benzene, chloroform, acetone and Petroleum ether) from the rhizome part of *Cyclea peltata* (Menispemaceae) were tested for the availability of alkaloids, glycosides,, phenolic compounds, saponins, tannins, flavonoids, terpenoids, steroids, phobatannins, coumarins, proteins, emodins and carbohydrates. The FT-IR spectrum showed the presence of alkyne (C-H), methylene (C-H), (O-H) stretch, (C-N) stretch, (C-O) group, (N-H) stretch, p-directing benzene ring, organic nitrates, aliphatic nitro compounds, ammonium ion and aromatic nitro compounds. The results confirm the fact that this plant posses important bioactive constituents useful for our health so further scientific investigation is needed.

Keywords: *Cyclea peltata;* FT-IR; bioactive constituents

Introduction
Plants produce bioactive molecules in a diverse range making them a rich source of different types of medicines [1-5]. Traditionally herbal extracts were known to be effective against microorganisms as a result; plants form the basis of modern medicine. Plants produce phytochemicals to protect themselves; but recent studies indicate that many phytochemicals can also protect humans against infectious diseases [5-10]. *Cyclea peltata* is an attractive, succulent medicinal plant of the family Menispermaceae. It is an endemic plant distributed in Etawa forest of Betul District, Madhya Pradesh, India [11]. They grow in arid, rocky regions in the foot hills of Etawa forest, Betul District [11]. *Cyclea peltata* present in India, Leaves and Rhizomes are edible and also take part in traditional medicine of our country [12]. Similarly dried powder of rhizome mixed with hot water and after cooling is given to cattles for increasing fertility.
Many recent studies revealed that *Cyclea peltata* is an important medicinal plant. Keeping the values of *C. peltata* in mind the present investigation was carried out to screen the biomolecules present in ethanol, benzene, chloroform, acetone, petroleum ether, aqueous and extracts of the rhizome part of *Cyclea peltata* collected from Etawa forest, Betul District, Madhya Pradesh, India and to determine their functional group using (FT-IR) spectral analysis.

Experimental Section
The rhizome part of *C. peltata* was collected from Etawa forest, Betul District, Madhya Pradesh, India. Extracts were prepared from fresh rhizome portion. 50 grams of rhizome parts were collected, smashed and soaked in 200ml of ethanol, benzene, chloroform, acetone, petroleum ether and distill water respectively. These flasks were kept in a shaker at room temperature for 24h. After incubation, the extracts filtered through Whatman No. 1 filter paper, collected and stored in a refrigerator at 4C. The extracts were concentrated using a vacuum evaporator and dried at 60C. Preliminary phytochemical screening and spectroscopic analysis was performed using standard procedures [13].

Fourier Transform Infrared Spectroscopic Analysis (FT-IR)
The rhizome of *C. peltata* was oven dried at 60 C and ground into fine powder using a mortar and pestle. Two milligrams of the sample was mixed with 100mg KBr (FT-IR grade) and then compressed to prepare a salt disc (3mm diameter). The disc was immediately kept in the sample holder and FT-IR spectra were recorded in the absorption range between 4000-650cm^{-1}. All investigations were carried out with a Perkin Elmer spectrometer (spectrum RX1, FT-IR V.2.0).

Results
Preliminary phytochemical screening was done in ethanol, benzene, chloroform, acetone, petroleum ether and distill water rhizome extracts of *C. peltata*. Of the six solvent extracts tested, steroids showed their presence in four extracts, alkaloids in three extracts and coumarins in all extract, Glycosides, phenol, saponins, tannins, flavonoids, terpenoids, phlobatannins, proteins and emodins were completely absent in all the extracts (Table 1).
The FT-IR spectrum was used to identify and detect the characteristic peaks and functional groups of the active components based on the peak value in the region of infrared radiation (Table 2; Figure 1). The results revealed the presence of different phytochemicals which are formed during the plants normal metabolic processes. The extract of *C. peltata* was subjected to FT-IR analysis and the functional groups of the components were separated based on their peak

ratios. The result confirmed the presence of characteristic band at 3328.06 cm^{-1} shows O-H stretching and at 2975.06 cm^{-1} shows the C-H stretching, at 2256.79 cm^{-1} shows the C=_ C group, at 1652.96 cm^{-1} shows C=N stretching, at 1416.44 cm^{-1} shows C-H bending, at 1275.55 cm^{-1} shows C-O group, at 801.60 cm^{-1} shows para directing benzene ring in Ethanolic extract. (Fig.1).

It exhibited characteristic band at 3679.64 cm^{-1} shows the presence of O-H stretching and at 3022.82 cm^{-1} shows the C-H stretching, at 2353.94 cm^{-1} shows the C=_N stretch, at 1714.63 cm^{-1} shows C=O stretching, at 1525.03 cm^{-1} shows C=C stretching, at 1424.96 cm^{-1} shows C-H bending in Chloroform extract. (Fig.2)

It exhibited characteristic band at 3588.08 cm^{-1} shows the presence of O-H stretching and at 2924.41 cm^{-1} shows the C-H stretching, at 2333.83 cm^{-1} shows the C=_ N stretching, at 1745.44 cm^{-1} shows C=O stretching, at 1462.30 cm^{-1} shows C-H bending, at 1247.40 cm^{-1} shows C-O group, at 1147.01 cm^{-1} shows the C-N group, at 814.31 cm^{-1} shows para directing benzene ring in Petroleum ether.(Fig.3)

It exhibited characteristic band at 3415.64 cm^{-1} shows the presence of N-H stretching and at 3275 cm^{-1} shows the N-H stretching, at 2922.39 cm^{-1} shows the C-H stretching, and at 2373.03 cm^{-1} shows C=_N stretching, at 1871.85 cm^{-1} shows C=O stretching, at 1628.05 cm^{-1} shows C=N stretching, at 1432.87 cm^{-1} shows C-H bending, at 1241.58 cm^{-1} shows C-O group in Distil water extract. (Fig.4 Table 2).

Discussion

Preliminary phytochemical screening of *Cyclea peltata* showed the availability of wide range phytoconstituents present. There are several reports to show that *Cyclea* is an important source of bioactive molecules. Phytochemical screening done in the ethanol, benzene, chloroform, acetone, petroleum ether and distill water extract of the rhizome of *C. peltata* was rich in alkaloids, steroids and coumarins [14]. Vajha and his coworkers separated the active compounds like alkaloids, steroids and coumarins present in the different solvent extract of *Cyclea peltata* [15].

The most significant plant *Cyclea peltata* (Lam.) Hook. F. & Thoms (Menispermaceae) is strongly advocated by the local veterinary practitioners for its significance. Tubers of this plant are used to increase fertility in cattles. The preliminary phytochemical analysis of tuber showed the presence of alkaloids in benzene, chloroform and acetone extract. Concentration of steroids have been extracted in benzene, acetone, petroleum ether and distil water extracts. All extract have shown positive test for coumarin. All extracts shown negative test for glycosides, phenols, saponins, tannins, flavonoids, terpenoids, phlobatannins, proteins, emodins and carbohydrates.

In the GC-MS analysis identification of phytochemical compounds are based on the peak area, molecular weight and molecular formula. The GC-MS results of aqueous extract of rhizome showed out ten compounds. Three and seven were major and minor constituents respectively. The three major compounds includes Hexatriacontane (9.41 %), Triacontane, 11,20-Didecyl (6.09 %) and Octacosane (6.02 %) while minor constituents includes 1-Iodo-2-methyl Undecane (5.87 %), Eicosane, 7- Hexyl (4.94 %), 2-Bromotetradecane (4.16 %), Tetracosane (4.05 %), Heptadecane 2,6,10,15- Tetramethyl (3.34 %), Hexatriacontane (1.64 %) and Dotriacontane were found to be in a very less quantity constituting about (1.21 %) of the extract. Significant anti-inflammatory activity was noticed by Naik and Jadge in the ethanolic and aqueous extracts of whole plant of *C. peltata* [16].

Table 1: Preliminary Phytochemical screening of various extracts *Cyclea peltata* (Lamk.) Hook. (Obtained by successive solvent extraction of plant material) Present -- +ve Absent -- -ve

Plant Parts	Test / Reagents Used	Ethanol extract E	Benzene extract B	Chloroform Extract C	Acetone extract A	Petroleum Ether P	Distil Water extract W
Rhizome	Alkaloids (Hager's Test)	-	+	+	+	-	-
	Glycosides (Libermann's Test)	-	-	-	-	-	-
	Phenols	-	-	-	-	-	-
	Saponins (Foam Test)	-	-	-	-	-	-
	Tannis (Braymer's Test)	-	-	-	-	-	-
	Flavonoids	-	-	-	-	-	-
	Terpenoids	-	-	-	-	-	-
	Steroids (Salkowski Test)	-	+	-	+	+	+
	Phobatannins (Precipitate Test)	-	-	-	-	-	-
	Coumarins	+	+	+	+	+	+
	Proteins (Xanthoproteic Test)	–	-	-	-	-	-
	Emodins	-	-	-	-	-	-
	Carbohydrates (Molisch Test)	-	-	-	-	-	-

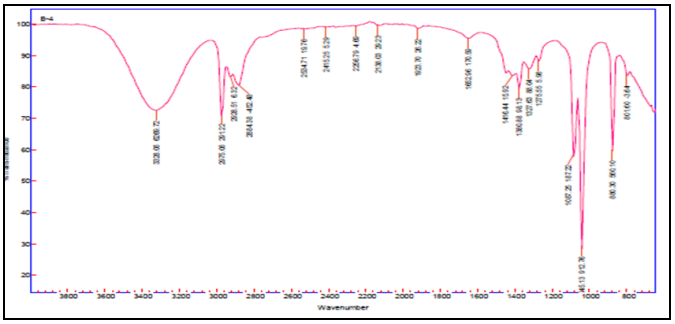

Fig 1: FT-IR spectrum of *Cyclea peltata* in Ethanolic extract

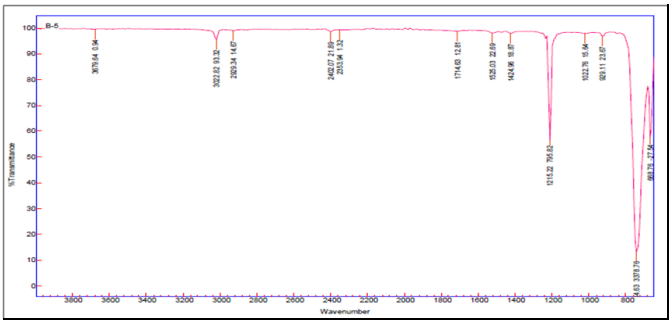

Fig 2: FT-IR spectrum of *Cyclea peltata* in Chloroform extract

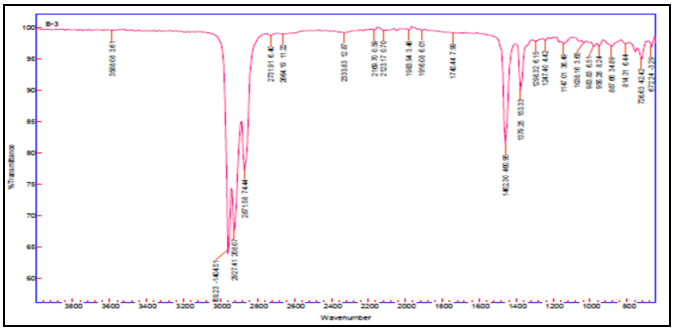

Fig 3: FT-IR spectrum of *Cyclea peltata* in Petroleum ether extract

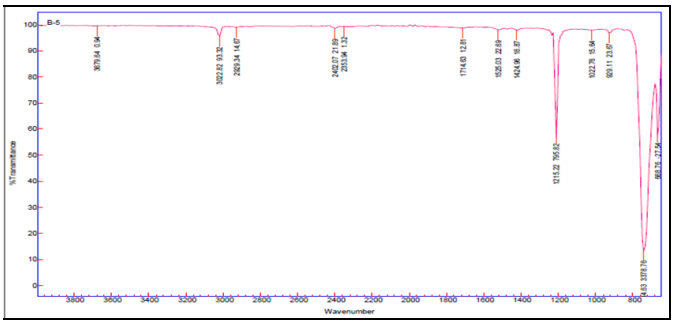

Fig 4: FT-IR spectrum of *Cyclea peltata* in Distil water extract

Table 2: FTIR peak values and functional groups of different extract of *Cyclea peltata*

Ethanol		Chloroform		Petroleum ether		Distil water	
Peak values	**Functional groups**	**Peak values**	**Functional groups**	**Peak values**	**Functional groups**	**Peak values**	**Functional groups**
3328.06	O-H stretch	3679.64	O-H stretch	3588.01	O-H stretch	3415.64	N-H stretch
2975.06	C-H stretch	3022.82	C-H stretch	2927.41	C-H stretch	3275	N-H stretch
2256.79	C=_ C group	2353.94	C=_ N stretch	2333.83	C=_N stretch	2922.39	C-H stretch
1652.96	C=N stretch	1714.63	C=O stretch	1745.44	C=O stretch	2373.03	C=_N stretch
1416.44	C-H bending	1525.03	C=C stretch	1462.30	C-H bending	1871.85	C=O stretch
1275.55	C-O group	1425.96	C-H bending	1247.40	C-O group	1628.05	C=N stretch
801.60	p- directing benzene ring			1147.01	C-N group	1432.87	C-H bending
				814.31	p-directing benzene ring	1241.58	C-O group

Conclusion

The result of the present study along with previous studies showed the presence of valuable compounds present in the plant. The study also justified the uses of the plant in the treatment of various types of diseases. Continuation of study on the same plant is required to identify, isolate, characterize and elucidate the structure of bioactive compounds present in it as there is no detailed study on this plant.

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