

## **Antibacterial Activity of *Mecodium exsertum* (Wall.ex Hook) Copel – A Rare Fern**

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### **Summary**

Antibacterial activity of *Mecodium exsertum* leaf extracts (alcoholic extract - eight fractions) was studied against selected pathogenic strains of *Aeromonas hydrophila*, *Bacillus subtilis*, *Klebsiella pneumoniae*, *Proteus vulgaris*, *Salmonella typhi*, *Staphylococcus aureus* and *Streptococcus pyogenes*. Preliminary phytochemical tests revealed the vital information regarding the high level accumulation of alkaloids, flavanoids, glycosides and terpenoids and seldom availability of oils, sapanin and tannin. The observations of the present study correlate the use of plants of this kind formulation of several herbal medicines.

**Key words:** *Mecodium exsertum*, Hymnophyllaceae, Antibacterial activity, phytochemicals.

### **Introduction**

Natural medicinal plant products have been used for millennia for the treatment of multiple ailments. Although many have been superseded by conventional pharmaceutical approaches, there is currently resurgence in interest in the use of natural products by the general public, which forms the basis of a world-wide, multi-million dollar major commercial industry. In addition, the pharmaceutical industry continues to examine their potential as sources of novel medicinal compounds to identify novel growth factor, immunomodulatory and potential anti-microbial agents (1).

The pteridophytes are first land vascular plants, distributed in various geoclimatic conditions throughout the world. The pteridophytes are known to man for more than 2000 years for their medicinal value. Since 1959, a search on phytochemical principles of such valuable medicinal ferns started. Spencer *et al.*, (1967) demonstrated antimalarial activity in the methanolic extract of *Selaginella ridellii* (2). Bhukuni *et al.*, (1969) observed anti cancerous activity in *Dicranopteris linearis* and *Selaginella plumose* (3). Banerjee *et al.* observed antibacterial activity in 74 species of fern and fern allies (4). Parihar and Bohra reported the antibacterial activity effect of several ferns (5-6). Victor *et al.* observed antibacterial activity in essential oil of *Adiantum capillus-veneris* leaves (7). Recently, the antibacterial activity of *Blechnum orientale* (L.) and *Drynaria quercifolia* (L.) has been studied (8-9). In the present study chloroform extract was partitioned with benzene, benzene: acetone (20:10) and n - butyl alcohol eluted the eight fractions at 1mg/ml were tested against the standard stains of *Aeromonas hydrophyla*, *Bacillus subtilis*, *Klebsiella pneumoniae*, *Proteus vulgaris*, *Salmonella typhi*, *Staphylococcus aureus* and *Streptococcus pyogenes* by disc diffusion method and MIC using macro broth dilution method.

### **Materials and Methods**

#### ***Collection of Plant materials***

*Mecodium exsertum* (Hymnophyllaceae), leaves were collected from the Upper Kodaiyar region, Kalakad Mundanthurai Tiger – Reserve Forest, Tirunelveli District, Tamil Nadu, India.

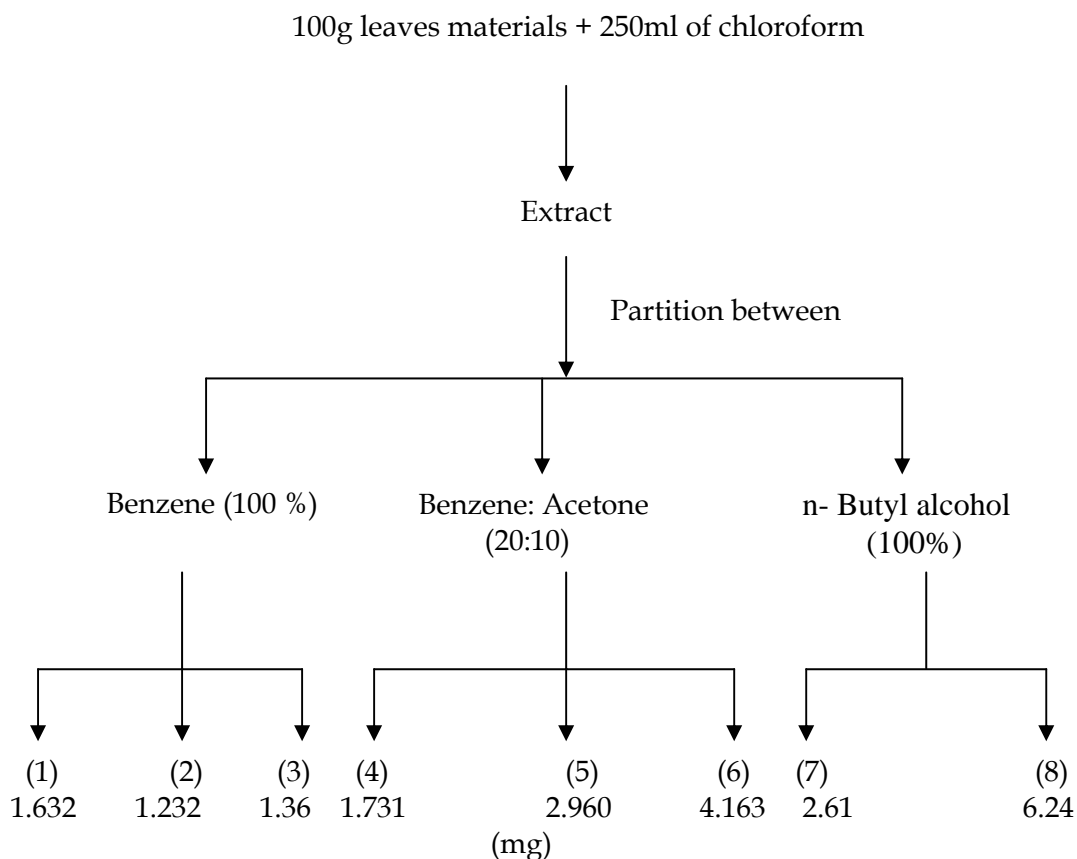
#### ***Extraction method***

100gms shade-dried powdered leaves were extracted with Chloroform (250ml) using a Soxhlet apparatus for 5h. This extract was filtered, to concentrated in vacuo. Dried CHCl<sub>3</sub> extract was chromatographed on column silica gel (Meze-size120) column using a solvent containing 100% Benzene: Acetone (20:10) and n-butyl alcohol (100%) fractions.

#### ***Bacterial strains***

Gram - positive strains *Bacillus subtilis*, *Staphylococcus aureus* and *Streptococcus pyogenes*, and the Gram - negative strains *Aeromonas hydrophila*,

*Klebsiella pneumoniae*, *Proteus vulgaris* and *Salmonella typhi* were tested. Cultures of these bacteria were grown in nutrient agar medium at  $37 \pm 1^\circ\text{C}$  and maintained on slopes  $4^\circ\text{C}$ . The antibacterial activity was conducted using disc method (10). MIC values were determined by the broth dilution assay method (10).



**Figure 1:** Schematic diagram of the extraction procedure and collected fractions for leaves of *M. excertum*.

### Results and Discussion

Crude extract was eluted into eight fractions separately and tested for antibacterial activity against the selected pathogenic strains of both gram negative and gram positive bacteria. The percentage of activity against each fraction is shown in table 1.

**Table 1:** Percentage of inhibition of test organisms against leaves of *Mecodium exsertum*

Sl.No.	Fraction	% inhibition
1	<b>Benzene</b>	
	Fraction (1)	43
	Fraction (2)	43
	Fraction (3)	43
2	<b>Benzene: Acetone (20:10)</b>	
	Fraction (4)	43
	Fraction (5)	57
	Fraction (6)	71
3	<b>n-butyl alcohol</b>	
	Fraction (7)	71
	Fraction (8)	43

The antibacterial activity of eight fractions was tested from 1mg/ ml concentration, and the MIC of fractions were presented table 2.

**Table 2:** Antibacterial activity (MIC) of the fractions of the leaves *Mecodium exsertum* leaves

Sl.No.	Test organisms	Concentrations (fraction) ( $\mu\text{g/ml}$ )
1	<i>Aeromonas hydrophila</i>	350 (5)
2	<i>Bacillus subtilis</i>	325 (8)
3	<i>Salmonella typhi</i>	125 (2)
4	<i>Klebsiella pneumoniae</i>	325 (6)
5	<i>Streptococcus pyogenes</i>	250 (1)
6	<i>Staphylococcus aureus</i>	125 (8)
7	<i>Proteus vulgaris</i>	0.150(5)

The zones of inhibition formed around the discs were measured (figure – 2), average values have calculated and tabulated. Benzene: Acetone fraction (5) showed maximum zone of inhibition against gram - negative strains of *Aeromonas hydrophila*, while the *Bacillus subtilis* have been observed to act as primary invaders or secondary infectious agents in a number of diseases and have been implicated in some cases of food poisoning. Gram-positive strains of *Bacillus subtilis* resistant are fractions 5, 6 and 8. A previous study of *S. aureus* was susceptible to ethanolic, methanolic and chloroform extracts whereas *B. subtilis* was susceptible to methanolic extract of *D. quercifolia* alone (9). N - Butyl alcohol fraction (8) showed higher sensitivity against *Streptococcus pyogenes* and minimum sensitivity against *Staphylococcus aureus*. Benzene fraction 2 was effective against typhoid inducing organisms of *Salmonella typhi*, while similar results was observed in several traditional plants of *Adiantum capillus-veneris* and *Athyrium pectinatum* and the less activities of *Chelianthus albomarginata*, *Dryopteris* species, *Adiantum incisum* and *Tectaria macrodonta* (5-6). The results of preliminary phytochemical screening of chloroform extract of *Mecodium exsertum* leaves showed the presence of alkaloids, flavanoids, glycosides and terpenoids and the seldom presence of sapanin and tannin (Table.3).

### Conclusions

Eight different fractions of chloroform extract of *Mecodium exsertum* were significantly effective against the Gram- positive and Gram – negative bacterial strains. The benzene and acetone (20:10) fraction (7) was highly active against *Aeromonas hydrophila* which is a serious infectious agent in etiology. Other fractions were resistant to *Bacillus subtilis*, *Streptococcus pyogenes*, *Staphylococcus aureus* and *Salmonella typhi*. Further characterization studies viz., HPLC, spectral data of these active constituents and subsequent post antibiotic evaluation are being the need of the hour to authenticate the utility of the plants of this kind in tribal medicine.

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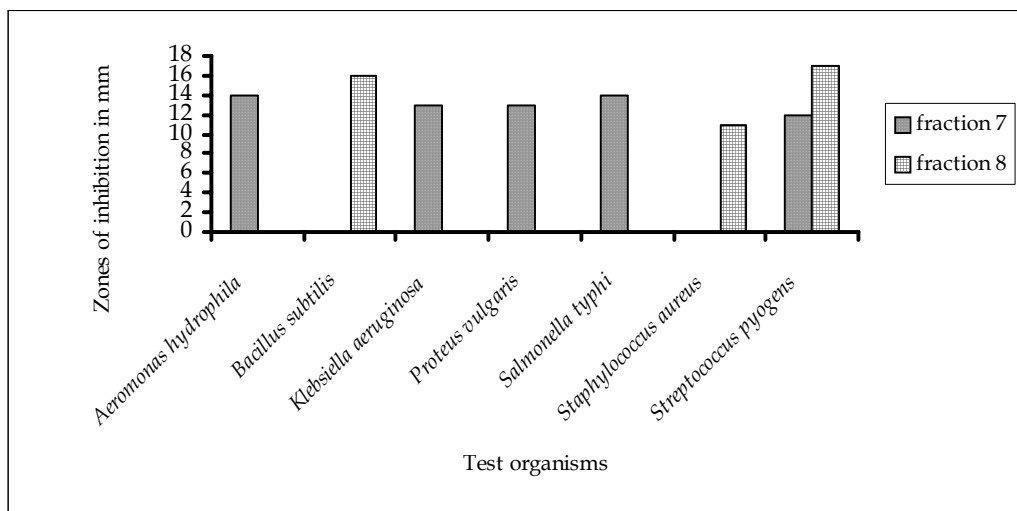
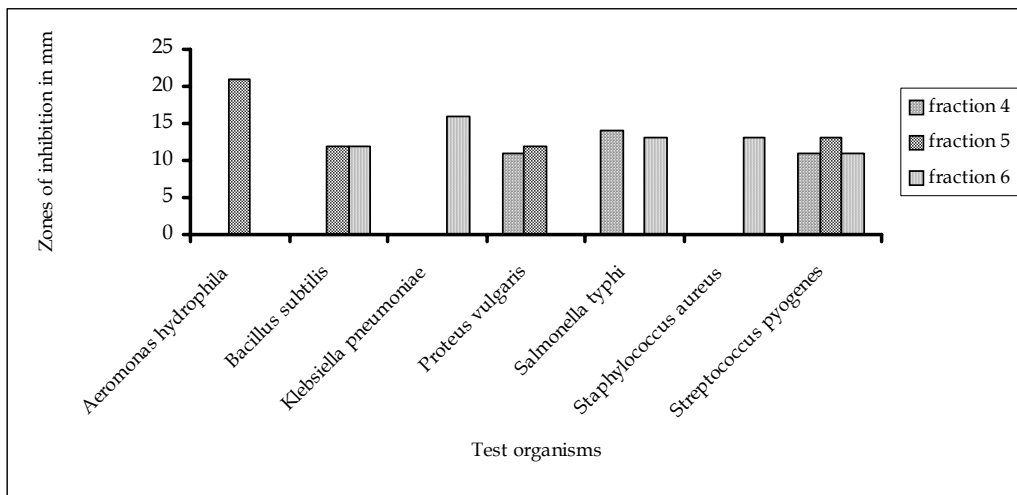
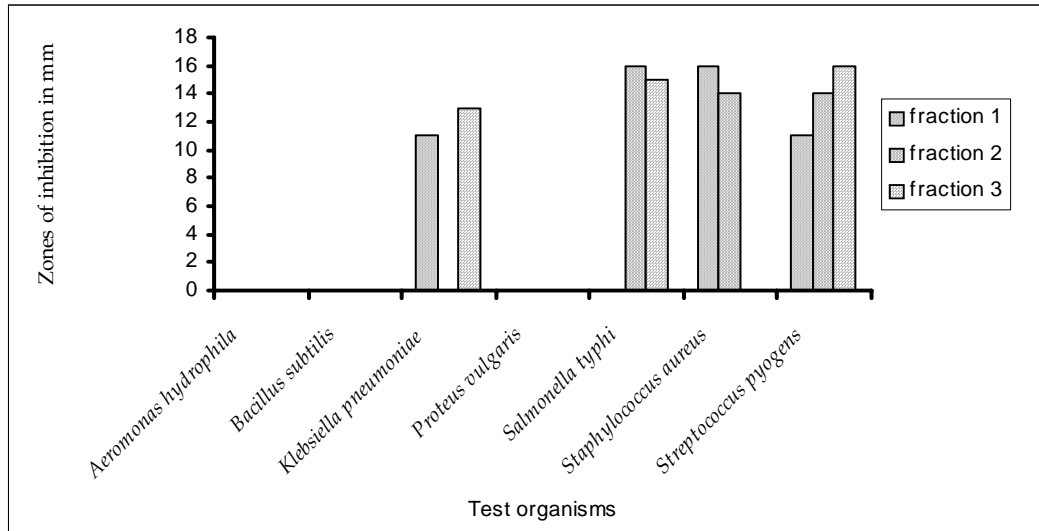


Fig.2: Zone of inhibition of test organisms against leaves of *Mecodium exsertum*

**Table 3:** Phytochemical screening of chloroform extract of *Mecodium exsertum* leaves

Chemicals	Present
Alkaloids	+++
Glycosides	++
Flavanoids	+++
Terpenoids	++
Sapanin	+
Tannin	+

+ Present (meager), ++ Present (moderate), +++ present (abundant), – Absent

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