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Comparative analysis of the phytochemical properties of leaf extracts of *Euphorbia hirta*, *Moringa oleifera*, *Hibiscus rosa-sinensis* and *Ocimum tenuiflorum*

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Abstract- The current study explores the phytochemical constituents of four medicinal plants found in Jharkhand, India: *Euphorbia hirta* (commonly known as asthma plant), *Ocimum tenuiflorum*, *Moringa oleifera*, and *Hibiscus rosa-sinensis*. Qualitative phytochemical screening of the aqueous, acetone and 70% ethanol extracts showed that all four medicinal plants have a variety of secondary metabolites, including alkaloids, flavonoids, terpenoids, tannins saponins, glycosides, phenols and steroids. While all three extraction methods yielded results, overall acetone and ethanolic extracts contained the highest levels of phytochemicals. In summary, these findings signify that *Euphorbia hirta*, *Ocimum tenuiflorum*, *Moringa oleifera* and *Hibiscus rosa-sinensis* can be used for folk medicinal use and provide encouraging evidence for future pharmacological studies.

Keywords: Phytochemicals, Traditional medicine, Bioactive compounds, Plant extracts, Secondary metabolites

INTRODUCTION

Medicinal plants serve as important sources of bioactive compounds around the world, particularly in the treatment of chronic diseases such as cancer, diabetes, and cardiovascular diseases. The pharmacologic activity of any plant is attributed to the presence of secondary metabolites such as alkaloids, flavonoids, phenols, terpenes, and saponins.¹ The important role that natural compounds derive from medicinal plants can be seen with Vinca alkaloids from *Catharanthus roseus* and paclitaxel derived from *Taxus baccata*.¹ In this study, I will investigate the phytochemistry of the four medicinal plants, *Euphorbia*

hirta, *Moringa oleifera*, *Hibiscus rosa-sinensis*, and *Ocimum tenuiflorum*, which are used substantially in traditional Indian medicine; which has historically been used to treat a variety of gastrointestinal issues, respiratory diseases, and even metabolic disorders.

Plant Descriptions and Ethnobotanical Relevance

Euphorbia hirta is an annual herb known as the asthma plant, which was traditionally used for respiratory and gastrointestinal ailment. The phytopharmacology studies have identified its antipyretic, analgesic, anti-inflammatory, and antimicrobial activities.³ *Moringa oleifera*, or drumstick tree, contains a variety of phytochemicals (flavonoids, alkaloids, saponins, phenolics) that have been traditionally used to treat diabetes, skin

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infection, and digestive disorders.⁴ *Hibiscus rosa-sinensis* is an ornamental shrub used in traditional Chinese medicine and Ayurvedic medicine. The leaves and flowers are believed to possess anti-inflammatory, antioxidants, and promote hair growth.⁵ *Ocimum tenuiflorum* i.e. Holy Basil, is cherished by Indian households and Indian medicine for its wide ranging pharmacological uses including, antimicrobial, antioxidant, and adaptogenic activities.⁶

MATERIALS & METHODS

Plant Collection and Preparation: Leaves of all four plant species were collected from Jamshedpur, Jharkhand. After shade drying and grinding into powder, 10g of each sample was subjected to maceration in acetone, aqueous, and 70% ethanol solvents at 37°C using an orbital shaker. Extracts were concentrated using a rotary evaporator at 45°C and stored at -20°C.

Phytochemical Screening: Standard qualitative tests were conducted to detect the presence of alkaloids (Mayer's reagent), flavonoids (alkaline reagent test), steroids (acetic anhydride + H₂SO₄ test), phenols and tannins (lead acetate test), terpenoids (Salkowski test), saponins (foam test), and glycosides (Keller-Killiani test).^{7,8}

Table 1: Phytochemical analysis of acetone, aqueous and 70% ethanolic extracts of *Euphorbia hirta*, *Moringa oleifera*, *Hibiscus rosa-sinensis* and *Ocimum tenuiflorum*.

Sl. No.	Phyto-chemicals	<i>Euphorbia hirta</i>			<i>Ocimum tenuiflorum</i>			<i>Moringa oleifera</i>			<i>Hibiscus rosa-sinensis</i>		
		Aqueous Extract	Acetone Extract	70% Ethanolic Extract	Aqueous Extract	Acetone Extract	70% Ethanolic Extract	Aqueous Extract	Acetone Extract	70% Ethanolic Extract	Aqueous Extract	Acetone Extract	70% Ethanolic Extract
1	Alkaloid	-	+	+	-	+	+	-	+	+	+	+	+
2	Glycosides	-	+	+	-	-	+	-	+	+	+	+	-
3	Terpenoids	+	+	+	-	+	+	+	+	+	+	-	-
4	Flavonoid	-	-	-	+	-	-	-	-	-	+	+	+
5	Phenols	+	+	+	+	+	+	+	+	+	+	-	-
6	Tannins	+	+	+	-	+	-	+	+	+	+	+	-
7	Steroids	+	+	+	+	+	+	+	+	+	+	-	-
8	Saponins	+	+	+	-	+	+	+	+	+	+	-	+

The acetone extract of *Euphorbia hirta* showed a full range of phytochemicals, including alkaloids, glycosides, flavonoids, terpenoids, phenols, and steroids. The presence of flavonoids and terpenoids is especially significant for their antioxidant and anti-inflammatory properties.⁹ Phenols and tannins further contribute to its antioxidant potential.¹⁰ *Ocimum tenuiflorum* showed solvent-specific phytochemical distributions. The aqueous extract was rich in flavonoids and phenols, while the ethanolic extract revealed alkaloids and glycosides. These components justify its traditional use in treating oxidative stress and infections.¹¹ *Moringa oleifera* extracts showed the presence of alkaloids, glycosides, phenols, and

RESULTS & DISCUSSION

Yield of Extracts

The aqueous extract of *Euphorbia hirta* yielded the highest percentage (11.2%), followed by acetone (9.4%) and ethanolic (8.2%) extracts. *Ocimum tenuiflorum* showed maximum yield in 70% ethanol (10.4%), while *Hibiscus rosa-sinensis* showed the highest yield with acetone (10.8%). This variability highlights the differential solubility of plant metabolites in various solvents.

Phytochemical analysis

The phytochemical screening of acetone, aqueous, and 70% ethanolic extracts from four medicinal plants revealed distinct phytochemical profiles (Table 1). Alkaloids were consistently absent in all aqueous extracts but present in acetone and ethanolic extracts of all species except the negative controls. Phenols showed the highest distribution, being present in all extracts of *Euphorbia hirta*, *Ocimum tenuiflorum*, and *Moringa oleifera*, while absent in *Hibiscus rosa-sinensis* acetone and ethanolic extracts. Steroids were detected in all extracts except *Hibiscus rosa-sinensis*. Terpenoids were widely distributed but notably absent in *Ocimum tenuiflorum* aqueous extract and both acetone and ethanolic extracts of *Hibiscus rosa-sinensis*.

terpenoids across solvents. The detection of these compounds aligns with its documented antioxidant, antimicrobial, and anti-inflammatory activities.¹² *Hibiscus rosa-sinensis* consistently exhibited alkaloids and flavonoids in all extracts. The aqueous extract demonstrated the broadest profile, supporting traditional aqueous-based preparations. The glycosides identified in acetone and aqueous extracts suggest cardioprotective benefits.¹³

CONCLUSION

Phytochemical analysis of *Euphorbia hirta*, *Moringa oleifera*, *Hibiscus rosa-sinensis*, and *Ocimum tenuiflorum* revealed that solvent type significantly affects the extraction

of bioactive compounds. Acetone and 70% ethanol were the most efficient, extracting diverse secondary metabolites including alkaloids, flavonoids, terpenoids, phenols, glycosides, and steroids. *E. hirta* exhibited the richest phytochemical profile, especially in acetone extract. *O. tenuiflorum*'s aqueous extract was high in flavonoids and phenols, supporting its traditional antioxidant use. *M. oleifera* showed consistent therapeutic compounds across all solvents. *H. rosa-sinensis* had the broadest phytochemical spectrum in aqueous extract.

The ethnopharmacological approach highlights traditional knowledge and provides a basis for further studies to isolate active compounds and evaluate their pharmacological potential for modern therapeutic applications.

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