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Phytochemical Profiling and GC–MS Analysis of *Psoralea corylifolia* Linn.

[*1] Dr. Tripti Bisaria

[*1] Assistant Professor, D.B.S. (PG) College, Kanpur, Uttar Pradesh, India.

*Corresponding Author
Dr. Tripti Bisaria
Assistant Professor, D.B.S. (PG) College,
Kanpur, Uttar Pradesh, India.

Abstract
Psoralea corylifolia Linn. (Babchi) is an important medicinal plant widely used in traditional systems of medicine for the treatment of skin disorders and other chronic ailments. Its therapeutic efficacy is attributed to the presence of diverse bioactive phytochemicals such as furanocoumarins, flavonoids, and phenolic compounds. Phytochemical profiling using modern analytical techniques is essential to scientifically validate its medicinal value. Gas chromatography–mass spectrometry (GC–MS) is a reliable tool for identifying volatile and semi-volatile constituents in plant extracts. The present study focuses on phytochemical screening and GC–MS analysis of *Psoralea corylifolia* Linn. To elucidate its chemical composition and potential pharmaceutical significance. Qualitative phytochemical screening revealed the presence of flavonoids, phenolics, terpenoids, coumarins, fatty acids, and glycosides. GC–MS analysis identified eighteen major bioactive compounds, including bakuchiol, psoralen, isopsoralen, phytol, linoleic acid, oleic acid, and hexadecanoic acid. These compounds are reported to possess antioxidant, antimicrobial, anti-inflammatory, and dermatoprotective properties. The results provide scientific validation for the traditional use of *P. corylifolia* and highlight its potential as a valuable source of bioactive natural products.

Keywords: *Psoralea corylifolia*, phytochemical screening, GC–MS, bakuchiol, medicinal plants

Introduction
Medicinal plants remain a cornerstone of traditional healthcare systems and continue to contribute significantly to modern drug discovery. Secondary metabolites derived from plants exhibit diverse biological activities and form the basis of many therapeutic agents. *Psoralea corylifolia* Linn., belonging to the family Fabaceae, is a prominent medicinal plant widely distributed in India and China. The seeds of the plant are traditionally used in the management of psoriasis, vitiligo, leprosy, asthma, and microbial infections.

Phytochemical investigations have revealed that *P. corylifolia* is rich in coumarins (psoralen, isopsoralen), flavonoids (bavachin, isobavachin), and meroterpenes such as bakuchiol, which contribute to its pharmacological activities. Despite extensive traditional use, systematic chemical profiling using advanced analytical techniques is essential to understand the complexity of its bioactive constituents. Gas Chromatography–Mass Spectrometry (GC–MS) is a powerful analytical tool widely used for the identification of volatile and semi-volatile phytochemicals. The present study focuses on phytochemical profiling and GC–MS analysis of *P. corylifolia* to correlate its chemical constituents with therapeutic potential.

Materials and Methods
Collection and Authentication of Plant Material
Seeds of *Psoralea corylifolia* were collected from a local herbal source and authenticated by a qualified taxonomist. The collected material was cleaned, shade-dried, and ground into fine powder using a mechanical grinder.

Fig 1: Habit of Psoralea corylifo

Fig 2: Seeds of Psoralea corylifolia

Preparation of Plant Extract
Approximately 50 g of powdered plant material was extracted with methanol using Soxhlet extraction for 6–8 hours. The extract was filtered and concentrated under reduced pressure using a rotary evaporator. The dried extract was stored at 4 °C until further analysis.

Preliminary Phytochemical Screening
Standard qualitative tests were performed to detect the presence of alkaloids, flavonoids, phenolics, tannins, saponins, terpenoids, steroids, glycosides, and coumarins using established phytochemical protocols.

GC–MS Analysis
GC–MS analysis was carried out using a gas chromatograph coupled with a mass spectrometer equipped with a capillary column. Helium was used as the carrier gas. The injector temperature, oven temperature program, and ionization energy were set under standard operating conditions. Compound identification was achieved by comparing the mass spectra with NIST library data.

Results
Phytochemical Screening
Preliminary phytochemical analysis confirmed the presence of major secondary metabolites including flavonoids, phenolics, terpenoids, coumarins, fatty acids, and glycosides, indicating the medicinal significance of *P. corylifolia*.

GC–MS Chemical Composition
Table 1 presents the GC–MS-identified phytochemical constituents of the methanolic extract of *Psoralea corylifolia*.

Table 1: GC–MS Identified Phytochemical Constituents of *Psoralea corylifolia*

S. No.	RT (min)	Compound Name	Molecular Formula	Molecular Weight (g/mol)	Peak Area (%)	Biological Activity
1	5.12	2,4-Di-tert-butylphenol	$C_{14}H_{22}O$	206.32	2.48	Antioxidant
2	6.87	Decane, 3-methyl-	$C_{11}H_{24}$	156.31	1.62	Antimicrobial
3	8.34	Dodecane	$C_{12}H_{26}$	170.33	1.94	Antibacterial
4	10.16	Tetradecane	$C_{14}H_{30}$	198.39	2.11	Antimicrobial
5	12.04	Hexadecane	$C_{16}H_{34}$	226.44	3.25	Antimicrobial
6	13.78	Phytol	$C_{20}H_{40}O$	296.54	5.63	Anti-inflammatory
7	14.92	Neophytadiene	$C_{20}H_{38}$	278.51	3.98	Anti-inflammatory
8	16.08	Hexadecanoic acid methyl ester	$C_{17}H_{34}O_2$	270.45	6.85	Antioxidant
9	17.36	Hexadecanoic acid	$C_{16}H_{32}O_2$	256.43	8.42	Antibacterial
10	18.24	Linoleic acid methyl ester	$C_{19}H_{34}O_2$	294.47	7.96	Anti-inflammatory
11	19.18	Linoleic acid	$C_{18}H_{32}O_2$	280.45	9.38	Cardioprotective
12	20.11	Oleic acid	$C_{18}H_{34}O_2$	282.46	6.54	Antimicrobial
13	21.05	Stearic acid	$C_{18}H_{36}O_2$	284.48	4.89	Antibacterial
14	22.44	Bakuchiol	$C_{18}H_{24}O$	256.38	10.92	Antioxidant, antimicrobial
15	23.61	Psoralen	$C_{11}H_6O_3$	186.16	6.11	Photosensitizing
16	24.38	Isopsoralen	$C_{11}H_6O_3$	186.16	4.97	Antimicrobial
17	25.17	Squalene	$C_{30}H_{50}$	410.73	2.85	Antioxidant
18	26.42	α-Tocopherol	$C_{29}H_{50}O_2$	430.71	3.16	Antioxidant

Discussion
The phytochemical screening and GC–MS analysis revealed that *Psoralea corylifolia* possesses a diverse array of bioactive compounds that substantiate its traditional medicinal applications. The predominance of fatty acids, terpenoids, phenolics, and coumarins suggests strong antioxidant and antimicrobial potential.

Bakuchiol, identified as a major compound, is a well-known meroterpene with anti-aging, antimicrobial, and anti-inflammatory properties. Its presence explains the extensive use of *P. corylifolia* in dermatological formulations. Coumarins such as psoralen and isopsoralen are clinically important compounds used in photochemotherapy for skin disorders like vitiligo and psoriasis.

The detection of fatty acids such as linoleic acid, oleic acid, and hexadecanoic acid indicates membrane-stabilizing, anti-inflammatory, and antimicrobial activities. Phytol and neophytadiene are diterpenes reported to exhibit antioxidant and immunomodulatory effects. The presence of α-tocopherol and squalene further enhances the antioxidant capacity of the extract, contributing to cellular protection against oxidative stress.

Overall, the GC–MS profile highlights the synergistic action of multiple bioactive compounds, supporting the pharmacological relevance of *P. corylifolia*. These findings validate its ethnomedicinal use and provide a scientific basis for further isolation and characterization of lead compounds.

Conclusion
The present study demonstrated that *Psoralea corylifolia* is a rich source of biologically active phytochemicals. Preliminary phytochemical screening and GC–MS analysis confirmed the

presence of several therapeutically important compounds, particularly bakuchiol, psoralen, fatty acids, and antioxidants. The results provide scientific support for the traditional use of *P. corylifolia* and suggest its potential application in pharmaceutical and nutraceutical development. Further studies focusing on bioactivity-guided fractionation and in-vivo evaluation are recommended.

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