J. Pharm. Res. 2024;23(1):40–48

Print ISSN: 0973-7200
Online ISSN: 2454-8405

Journal of Pharmaceutical Research

Original Article

# Analyzing the Phytochemistry and Bioactive Compounds of *Abutilon indicum* for antidiabetic activity Using TLC, HPTLC, GC-MS in Aqueous, Ethanol, and Chloroform Solvents for Pharmacognosy Determinations

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ARTICLE INFO

*Article history:*
Received 01.01.2024
Accepted 24.01.2024
Published 30.04.2024

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https://doi.org/
10.18579/jopcr/v23.1.2

ABSTRACT

In this systematic investigation of *Abutilon indicum* extracts for antidiabetic activity, using TLC and HPTLC were employed to analyze bioactive compounds. The ethanolic extract (EA) exhibited specific RF values: 0.16 for catechin, 0.57 for gallic acid, and 0.70 for quercetin, with *Abutilon indicum* (EA) containing the highest percentages—48.87% catechin, 27.45% gallic acid, and 7.25% quercetin. The robustly developed and validated HPTLC process, applied to ethanolic extracts, demonstrated clear bands and sharp peaks, ensuring precise separation of bioactive compounds. Similar methodologies were employed for chloroform extract (CA) and aqueous extract (AA), revealing RF values of 0.10, 0.36, and 0.54 for CA, and 0.087, 0.36, and 0.53 for AA, corresponding to catechin, gallic acid, and quercetin, respectively. Fingerprinting analysis confirmed the simultaneous presence of these compounds, highlighting the method's utility for quality control. Statistical analysis supported the reliability and cost-effective suitability of HPTLC for quantitative analysis in assessing herbal material and formulations. GC-MS exploration of *Abutilon indicum* extracts revealed over 20 compounds in each, including flavonoids, alkaloids, and terpenoids in the ethanolic extract, and phytosterols, alkaloids, and terpenoids in the chloroform extract. The aqueous extract displayed a diverse phytochemical composition, affirming medicinal potential. These results collectively endorse *Abutilon indicum's* versatility and therapeutic potential in herbal medicine and pharmaceutical formulations.

**Keywords:** Pharmacognosy; Bioactive Compounds; Analytical Study; Abutilon indicum etc

## INTRODUCTION

*Abutilon indicum*, a member of the Malvaceae ancestors and frequently known as mallow in English, is celebrated for its therapeutic properties. This plant offers numerous physical condition benefits, together with anti-inflammatory and anti-proliferative effects, arthritis pain relief, pain management, calming properties, liver protection, diabetes and cancer prevention, diarrhea and seizure control, lice eradication, wound healing, asthma alleviation, diuretic effects, and estrogen level reduction. *Abutilon indicum* Linn is a versatile remedy, enriched with beneficial chemicals such as saponins, flavonoids, glycosides, phytosterols, and phenolic compounds shown in Figure 1, making it a valuable resource for addressing a wide range of health conditions. As an Asian phytomedicine plant, it holds anti-diabetic and anti-bacterial properties. Traditionally, the paste of its leaves and seeds is employed to address syphilis, while the dried aerial parts alleviate bronchial asthma symptoms by enhancing pulmonary function. Additionally, the leaf paste is orally consumed for pain relief and to treat piles. The fruit decoction, when combined with ammonium chloride, is utilized against hemorrhagic septicemia. Furthermore, both aqueous and ethanolic extracts from the plant's leaves demonstrate immunomodulatory and phytochemical activities, enhancing circulating antibody titers in the blood. Notably, the leaf extract shows promising efficacy against human Caucasian lung carcinoma [1,2].

## MATERIALS AND METHODS

Place in the ground materials from *Abutilon indicum* were gathered in the Dhule local region, with authentication conducted by Associate Prof. Dr. S. R. Kshirsagar, who





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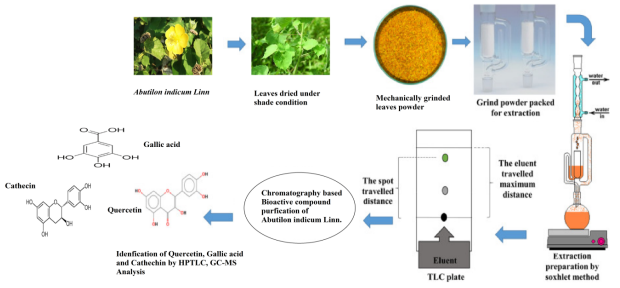



**Fig. 1: The extraction from the leaves of *Abutilon indicum* and its bioactive compounds for antidiabetic activity**

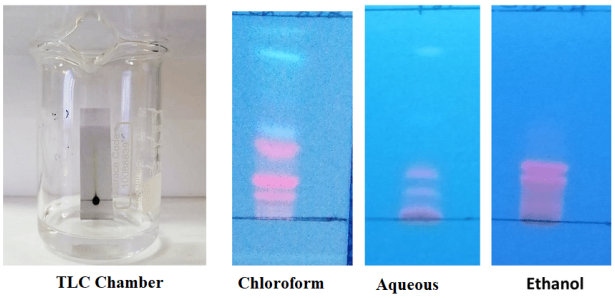



**Fig. 2: TLC of 3 different extract of *Abutilon indicum***

serves as the Head of the Botany Department at Dr. P. R. Ghogare Science College, affiliated with Karmveer in Dhule, Maharashtra.

### *Extraction of Plant Material*

*Abutilon indicum* leaves were processed into aqueous, ethanol, and chloroform extracts following the methodology outlined in the Indian Pharmacopoeia . After washing the leaves with running tap water, they were air-dried in the shade and then underwent Soxhlet extraction. A total of 50 grams of leaf powder was subjected to 24-hour extraction with aqueous, ethanol, and chloroform solvents using the aforementioned apparatus. The obtained extracts were safely store in sealed containers and kept in a refrigerator at 4°C for further investigation.

### *Thin layer chromatography*

Thin-layer chromatography of various extracts involves the following steps: Creating the TLC plate involved making slurry of gel 'G' with distilled water, applying a 0.25 mm thick layer to glass plates. Following air-drying for 10 minutes, the plates are then heated in a hot air oven at 105°C for 30 proceedings to activate them.

Preparing the sample solution involved creating a 0.1% solution of the aqueous extract, and any suspended impurities were filtered off. Choosing the solvent system:The choice of the solvent system or mobile phase influences the separation process. Solvents, selected based on their different polarity, were prepared as binary, ternary, or quaternary systems with a constant composition to achieve effective separation. Saturation of TLC chamber: Solvents were filled in a chamber up to a height of approximately 15 cm and marked. The chamber was lined with filter paper soaked in solvent, ensuring uniform distribution of solvent vapors throughout the vapor space, thereby saturating the chamber.

Application of spots: The prepared sample solution of the extract was applied to one end of the plate, approximately 1.5 cm from the bottom[3,4].

### *Development of chromatogram*

The plates were carefully placed into a pre-saturated TLC chamber, ensuring that the solvent saturated the TLC layer below the starting line. Capillary forces drove the solvents upward, carrying the substance mixture to be separated until it reached approximately $\frac{3}{4}$ of the TLC plate's height. Subsequently, the plate was taken out of the chamber, and the solvent was allowable to evaporate at room high temperature. The TLC-separated substances shown in Figure 2 detected at 245 nm and 366 nm with RF values 0.09, 0.37, 0.54, and 0.64.

1. HPTLC Fingerprinting of the given three extract of *Abutilon indicum* plant

- Aqueous extracts of *Abutilon indicum* by the High-Performance Thin Layer Chromatography parameter are shown in Table 1.

### *Sample Preparation*

The leaves of *Abutilon indicum* (Malvaceae) were air-dried and crushed into powder form. 500 grams of the pulverized substance were enclosed in muslin fabric furthermore underwent continuous hot extraction with water for 72 hours using a Soxhlet extractor. Following this, the aqueous extracts of *Abutilon indicum* leaves (EA) (Malvaceae) were filtered through Whatman paper No. 42, and the resulting filtrates were determined under reduced pressure and ultimately vacuum desiccated. The ethanolic extract yielded 5.2% w/w. The preparation of sample solutions was meticulously optimized for first-class fingerprinting and efficient extraction of marker compounds.

For each sample, 50 mg was weighed and dissolve in 5 ml of methanol and water (1:1) at a concentration of 10 mg/ml. The consequential way out was sonicated for 10 minutes, followed by centrifugation for 2 minutes at 2000 rpm. The clear supernatant solution was then applied to the plate, with 5, 2.0, and 5.0 microliters of each sample being applied to separate 10x10 plates. This corresponded to on-plate amounts of 5, 20, and 50 micrograms, respectively, shown in Figures 3, 4 and 5.

**Table 1: Chromatographic parameter for *Abutilon indicum* Aqueous extracts**

| Sr. No. | Parameter | Description |
|---|---|---|
| 1. | Instruments | CAMAG Linomat 5 |
| 2. | Stationary Phase | silica gel 60 $F_{254}$HPTLC Precoated plate |
| 3. | Spotting volume | 20 Micro Litre |
| 4. | Band Width | 70 mm from the lower edge of the Plate. |
| 5. | Syringe | Camag Linomat IV sample applicator |
| 6. | Mobile Phase | n-Butanol: Methanol: Water (3:1:1 v/v/v) |
| 7. | Volume of Mobile phase | 5.0 ml |
| 8. | Development Mode | Camag Twin Trough Chamber |
| 9. | Chamber saturation time | 15 Mint |
| 10. | Wavelength | 254nm, 366nm. |
| 11. | Densimeter Scanner | Camag TLC Scanner III |
| 12. | Software | Win CATS |
| 13. | Radiation source | D2, Tungsten and Mercury Lamp |

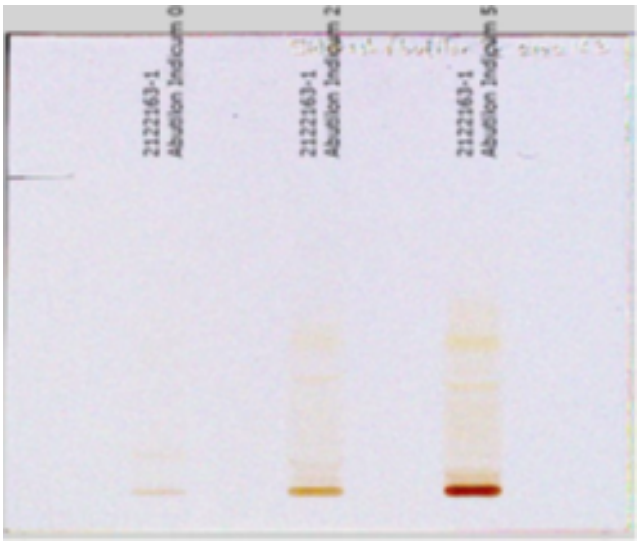


**Fig. 3: The Plate after development under White Light of *Abutilon indicum***

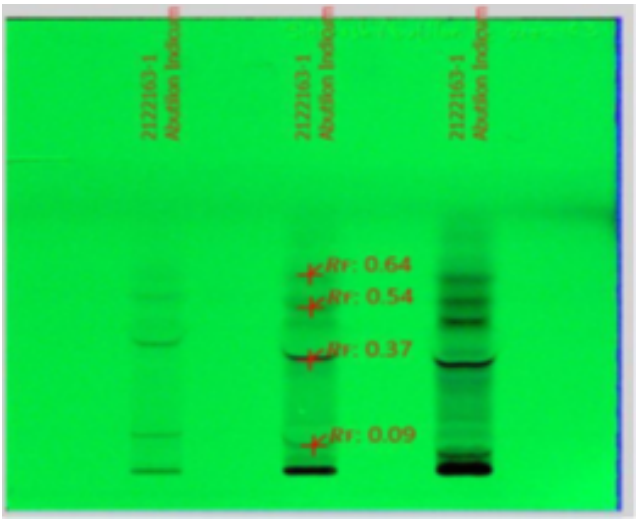



**Fig. 4: The Plate after development under R 254nm light for *Abutilon indicum***

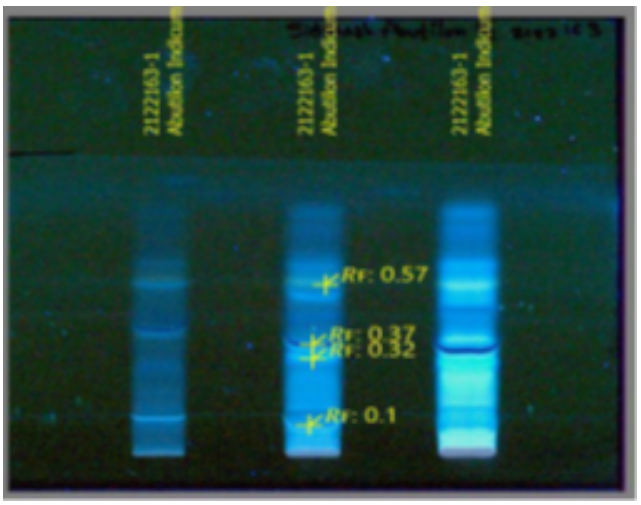



**Fig. 5: The Plate after Development: Image under R 366 nm light for *Abutilon* indicum**

**Derivatization:** 10% Sulphuric acid in methanol is used as a developing reagent. The developed plate is dipped in 10% Sulphuric acid for 2 seconds and heated at 110 °C for 3 minutes, as shown in Figures 3, 4 and 5 and tracks 1, 2, and 3 with respective wavelengths of 254 and 366 nm.

- Ethanol extracts of *Abutilon indicum* by High-Performance Thin Layer Chromatography: chromatographic parameters are shown in Table 2.

To create standard and QC samples, catechin, gallic acid, and quercetin stock solutions (10 mg/mL) in methanol were diluted to prepare standard solutions (0.1-1.0 mg/mL). Calibration involved applying GA (1-10 $\mu$L) and QE (0.5-5 $\mu$L) to HPTLC plates. Linear least squares weakening

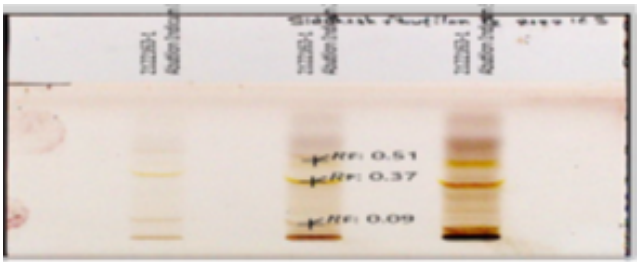



**Fig. 6: The plate after derivatization with 10% sulphuric acid: - Under white Light for *Abutilon indicum***

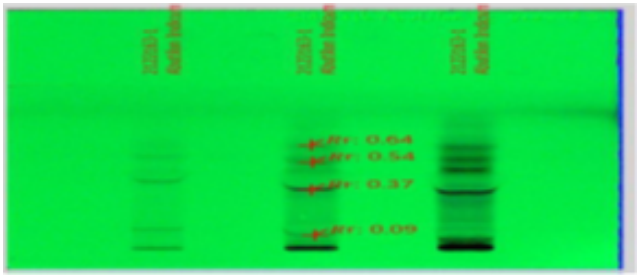



**Fig. 7: The plate after derivatization with 10% sulphuric acid: - Under 254 nm for *Abutilon indicum***

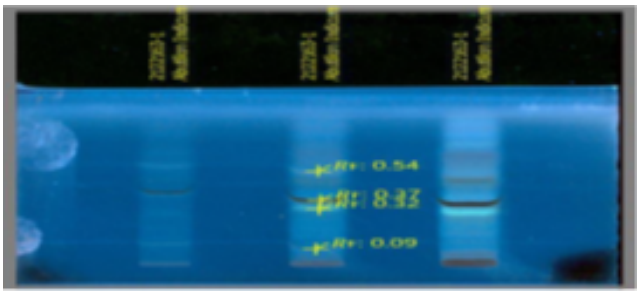



**Fig. 8: The plate after derivatization with 10% sulphuric acid: - Under 366 nm for *Abutilon indicum***

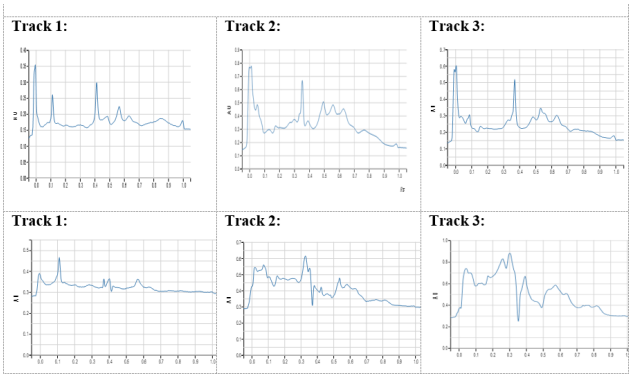



**Fig. 9: Wavelength 254nm Single λ**

**Table 2: Chromatographic parameter for *Abutilon indicum* ethanol extracts**

| Sr. No. | Parameter | Description |
|---|---|---|
| 1. | Instruments | CAMAG Linomat 5 |
| 2. | Stationary Phase | silica gel 60 $F_{254}$ HPTLC Precoated plate |
| 3. | Spotting volume | 20 Micro Litre |
| 4. | Band Width | 8 mm from the lower edge of the Plate. |
| 5. | Syringe | Camag Linomat IV sample applicator |
| 6. | Mobile Phase | n-Butanol: Methanol: Water (3:1:1 v/v/v) |
| 7. | Volume of Mobile phase | 5.0 ml |
| 8. | Development Mode | 20 cm×10 cm Camag Twin Trough Chamber |
| 9. | Chamber saturation time | 10 Mint |
| 10. | Wavelength | 530 nm. |
| 11. | Densimeter Scanner | Camag TLC Scanner III |
| 12. | Software | Win CATS |
| 13. | Radiation source | D2, Tungsten and Mercury Lamp |

was used, with each amount apply 6 times. Quality control samples (150, 300, 600 ng band-1 for GA; 200, 400, 800 for QE) validated the method.

Applying a properly diluted ethanolic extract, 10 $\mu$L of the sample solution was spotted on an HPTLC plate for High-Performance Thin Layer Chromatography UV 530 nm fingerprinting and image analysis and results are shown in Figures 6, 7 and 8. This process was replicated six times for each amount. Linear least-squares regression correlated peak area with applied amounts. Following plate development and scanning, peak areas were quantified, and the known amounts of catechin, gallic acid, and quercetin were determined using the calibration curve.

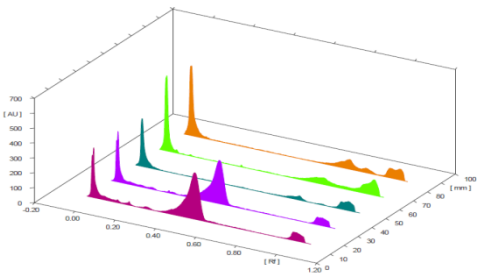


**Fig. 10: Catechin HPTLC analysis**

Utilizing methanol as the solvent system and under optimized chamber saturation conditions, a chromatogram for catechin, gallic acid, and quercetin was successfully

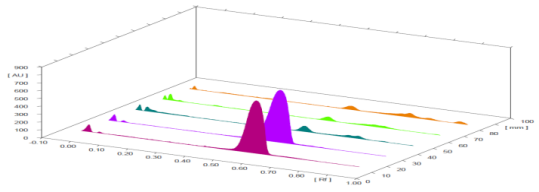


**Fig. 11: Gallic acid HPTLC analysis**

generated. The ideal saturation time was determined to be 10 minutes are shown in Figure 10. Notably, for catechin, the spots exhibited the highest absorbance at approximately 276 nm, for gallic acid at 271 nm, and for quercetin at 366 nm. Consequently, HPTLC spectra analysis was conducted at these specific wavelengths in the reflectance method, denoted as High-Performance Thin Layer Chromatography-UV 276 nm, 271 nm, and 366 nm. At Rf (0.67), the standard sample of catechin, gallic acid, and quercetin displayed condensed bands with sharp, proportioned, and high-resolution characteristics, particularly at Rf (0.63).

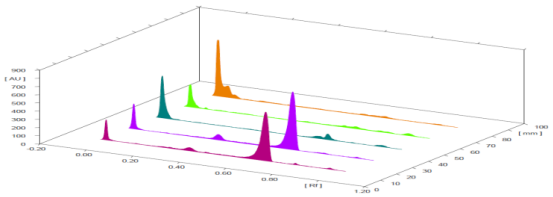


**Fig. 12: Quercetin HPTLC analysis**

- Chloroform extracts of *Abutilon indicum* by High-Performance Thin Layer Chromatography: Chromatographic parameter are shown in Table 3.

Chloroform stock solutions of quercetin, gallic acid, and catechin (10 mg/mL) were prepared for standard and QC samples. Diluting these solutions yielded standard solutions (0.1-1.0 mg/mL). Calibration involved applying GA (1-10 $\mu$L) and QE (0.5-5 $\mu$L) to an HPTLC plate, with linear least squares regression applied. QC samples at different concentrations (150, 300, 600 ng band-1 for GA and 200, 400, 800 ng band-1 for QE) ensured method reliability.picture analysis involved subjecting air-dried and powdered leaves of *Abutilon indicum* (Malvaceae) to continuous hot water extraction for 72 hours using a Soxhlet extractor. The resulting chloroform extracts were filtered, determined under reduced pressure, and vacuum dried, yielding a chloroform extract with a 4.6% w/w. The protocol for preparing test solutions was fine-tuned to optimize high-quality fingerprinting and efficient extraction of marker compounds shown in Figure 11.

To fingerprint the chloroform extracts of leaves from *Abutilon indicum* (Malvaceae), 10 $\mu$L of an appropriately diluted test solution of the aqueous extract was spotted

**Table 3: Chromatographic parameter for *Abutilon indicum* chloroform extracts**

| Sr. No. | Parameter | Description |
|---|---|---|
| 1. | Instruments | CAMAG Linomat 5 |
| 2. | Stationary Phase | silica gel 60 $F_{254}$HPTLC Precoated plate |
| 3. | Spotting volume | 20 Micro Litre |
| 4. | Band Width | 8 mm from the lower edge of the Plate. |
| 5. | Syringe | Camag Linomat IV sample applicator |
| 6. | Mobile Phase | n-Butanol: Methanol: Water (3:1:1 v/v/v) |
| 7. | Volume of Mobile phase | 5.0 ml |
| 8. | Development Mode | 20 cm×10 cmCamag Twin Trough Chamber |
| 9. | Chamber saturation time | 15 Mint |
| 10. | Wavelength | 530 nm. |
| 11. | Densimeter Scanner | Camag TLC Scanner III |
| 12. | Software | Win CATS |
| 13. | Radiation source | D2, Tungsten and Mercury Lamp |

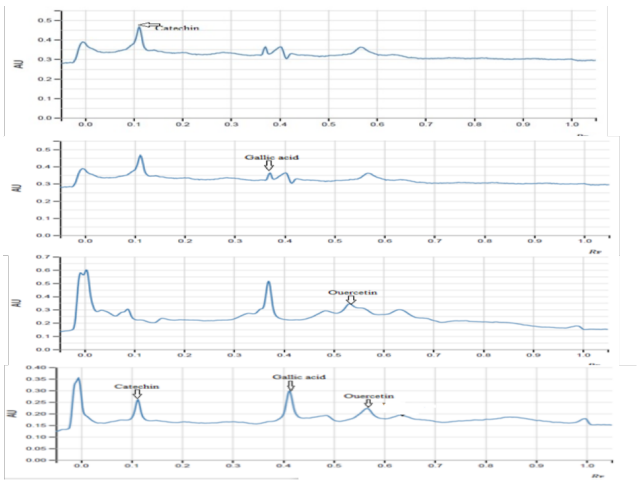



**Fig. 13: Fingerprinting analysis of *Abutilon indicum* of chloroform extracts**

on a High-Performance Thin Layer Chromatographyplate. This application was repeated 6 times for each amount. Linear least-squares regression was employed, considering the peak area and applied amounts. Subsequently, the plates underwent development and scanning, following the procedure discussed earlier. The recorded peak areas were then utilized to calculate the amounts of catechin, gallic acid, and quercetin, employing the calibration curve[5,6].

### *Gas Chromatography-Mass Spectrometry Analysis*

The GC-MS analysis was performed using a Perkin Elmer, USA, and System XL with NIST Library. The system was operated by Analyzer: Single Quadrupole with prefilter. GC-MS parameters are shown in Table 4. *Abutilon indicum* commonly referred to as Indian mallow or "Atibala" in Ayurveda, has a rich history of traditional medicinal use. Seeking to unravel its therapeutic potential, aqueous extracts of this plant underwent GC-MS profiling to identify the Phytochemical compounds present. This analytical technique enables the separation and characterization of a diverse array of compounds within the extract.

**Table 4: C-MS parameters for aqueous extract of *Abutilon indicum***

| Sr. No. | Instrument use | GC-MS |
|---|---|---|
| 1. | Model | Auto System Xl with Turbo Mass |
| 2. | Make | Perkin Elmer |
| 3. | Column Use | ELITE-5MS (30METERX0.250MMX0.) 250 Micro mm |
| 4. | Carrier gas | Helium |
| 5. | Flow rate | 01ml/min |
| 6. | Injector temp. | 260 $^{O}$C |
| 7. | Oven temp | 75 $^{O}$C Hold for 5min, rate 10 $^{O}$C per min up to 280 $^{O}$C hold for10 mint |
| 8. | EI Source temp | 220 $^{O}$C |
| 9. | Scan Range | 20 to 610 (amu) |
| 10. | Injection Volume | 2 micro liters |

The GC-MS analysis of *Abutilon indicum* aqueous extract unveiled a spectrum of phytochemicals, encompassing alkaloids, flavonoids, saponins, terpenoids, and other bioactive substances are shown in Figures 14 and 15. Among the noteworthy compounds identified are quercetin, kaempferol, and various alkaloids like vasicine.

These compounds collectively contribute to the plant's medicinal properties, offering benefits such as anti-inflammatory, antioxidant, and antimicrobial effects.

The gas chromatography-mass spectrometry profiling serves as valuable scientific evidence supporting the presence of these bioactive compounds, shedding light on its pharmacological and medicinal significance shown in Figures 16 and 17. Researchers continue to explore the plant's potential applications in modern medicine, aiming to harness its diverse phytochemical profile for the development of new pharmaceuticals or nutraceuticals products.

Examining the chloroform extract of *Abutilon indicum* through gas chromatography-mass spectrometry (GC-MS) offers valuable insights into the specific phytochemical compounds within this extract. This analytical technique facilitates the separation and identification of diverse compounds

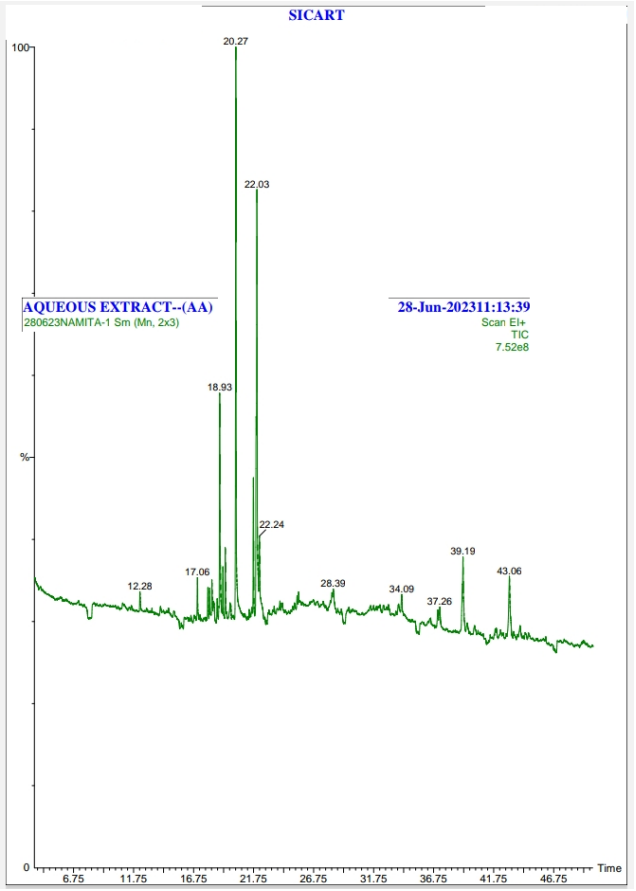
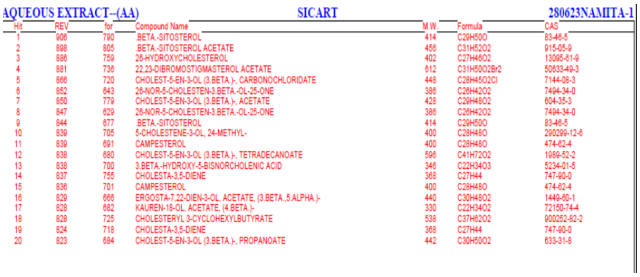



**Fig. 14: GC-MS analysis of aqueous extract of *Abutilon indicum***



AQUEOUS EXTRACT--(AA) SICART 280623NAMITA-1

| Hit | REV | fpr | Compound Name | M.W. | Formula | CAS |
|---|---|---|---|---|---|---|
| 1 | 906 | 790 | BETA.-SITOSTEROL | 414 | C29H50O | 83-46-5 |
| 2 | 898 | 805 | .BETA.-SITOSTEROL ACETATE | 456 | C31H52O2 | 915-05-9 |
| 3 | 886 | 759 | 26-HYDROXYCHOLESTEROL | 402 | C27H46O2 | 13095-61-9 |
| 4 | 881 | 736 | 22,23-DIBROMOSTIGMASTEROL ACETATE | 612 | C31H50O2Br2 | 50833-49-3 |
| 5 | 866 | 720 | CHOLEST-5-EN-3-OL (3.BETA.)-, CARBONOCHLORIDATE | 448 | C28H45O2Cl | 7144-08-3 |
| 6 | 852 | 643 | 26-NOR-5-CHOLESTEN-3.BETA.-OL-25-ONE | 386 | C26H42O2 | 7494-34-0 |
| 7 | 850 | 779 | CHOLEST-5-EN-3-OL (3.BETA.)-, ACETATE | 428 | C29H48O2 | 604-35-3 |
| 8 | 847 | 629 | 26-NOR-5-CHOLESTEN-3.BETA.-OL-25-ONE | 386 | C26H42O2 | 7494-34-0 |
| 9 | 844 | 677 | .BETA.-SITOSTEROL | 414 | C29H50O | 83-46-5 |
| 10 | 839 | 705 | 5-CHOLESTENE-3-OL, 24-METHYL- | 400 | C28H48O | 200299-12-6 |
| 11 | 839 | 691 | CAMPESTEROL | 400 | C28H48O | 474-62-4 |
| 12 | 838 | 680 | CHOLEST-5-EN-3-OL (3.BETA.)-, TETRADECANOATE | 566 | C41H72O2 | 1989-52-2 |
| 13 | 838 | 700 | 3.BETA.-HYDROXY-5-BISNORCHOLENIC ACID | 346 | C22H34O3 | 5234-01-5 |
| 14 | 837 | 755 | CHOLESTA-3,5-DIENE | 368 | C27H44 | 747-90-0 |
| 15 | 836 | 701 | CAMPESTEROL | 400 | C28H48O | 474-62-4 |
| 16 | 829 | 666 | ERGOSTA-7,22-DIEN-3-OL, ACETATE, (3.BETA.,5.ALPHA.)- | 440 | C30H48O2 | 1440-95-1 |
| 17 | 829 | 662 | KAUREN-18-OL, ACETATE, (4.BETA.)- | 330 | C22H34O2 | 72180-74-4 |
| 18 | 828 | 725 | CHOLESTERYL 3-CYCLOHEXYLBUTYRATE | 538 | C37H62O2 | 900252-82-2 |
| 19 | 824 | 718 | CHOLESTA-3,5-DIENE | 368 | C27H44 | 747-90-0 |
| 20 | 823 | 684 | CHOLEST-5-EN-3-OL (3.BETA.)-, PROPANOATE | 442 | C30H50O2 | 633-31-8 |

**Fig. 15: Phyto compound present in aqueous extract of *Abutilon indicum* using GC-MS Profiling (ADA: Antidiabetic activity)**

based on their mass and chemical properties, providing a comprehensive understanding of the constituents.

The GC-MS profiling of the chloroform extract of *Abutilon indicum* has uncovered the presence of several noteworthy phytochemicals. Chloroform extraction, known for enriching lipophilic compounds, has highlighted terpenoids, alkaloids, and other non-polar substances. Among the significant compounds identified in this extract are:

- **Phytosterols:** These plant sterols have cholesterol-lowering and anti-inflammatory properties.

- **Alkaloids:** *Abutilon indicum* Linn.Linn.is known for containing alkaloids such as vasicine, which can have various pharmacological effects.
- **Terpenoids:** These compounds have diverse therapeutic potential, with some acting as antioxidants, while others may have antimicrobial or anti-inflammatory properties.
- **Fatty acids:** Chloroform extraction often yields fatty acids that can be important for various biological processes and potentially contribute to the plant's medicinal properties.
- **Triterpenoids:** These compounds can exhibit anti-inflammatory and antioxidant activities.

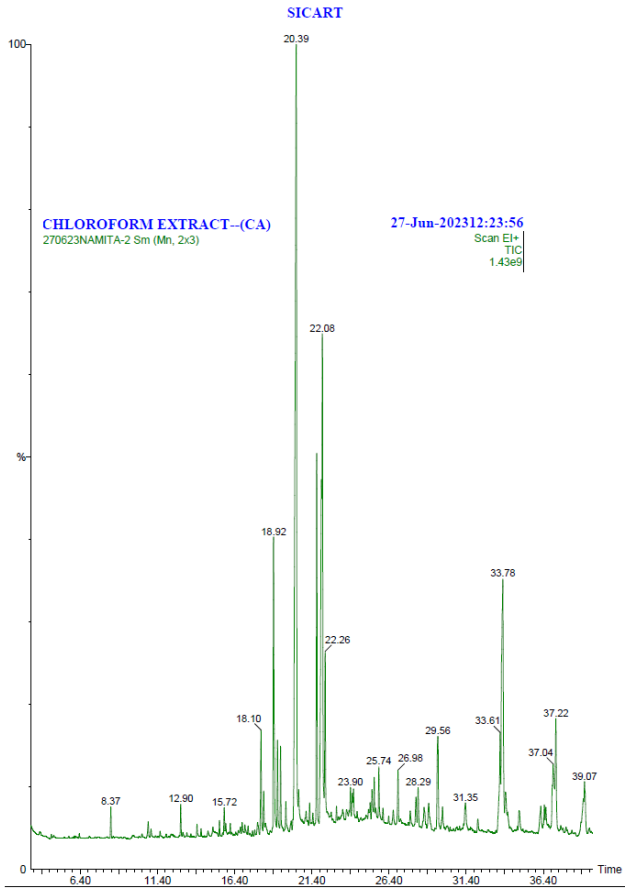
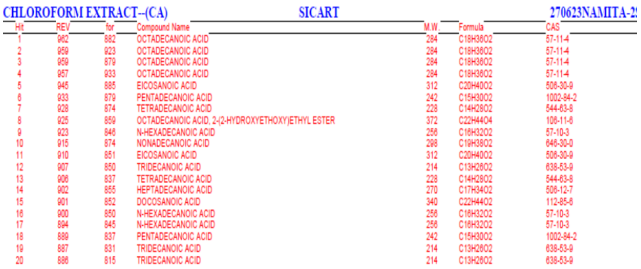



**Fig. 16: GC-MS analysis of chloroform extract of *Abutilon indicum***

*Abutilon indicum* as a source of bioactive compounds for pharmaceutical, nutraceuticals, or traditional medicine applications.

Utilizing GC-MS to analyze the ethanol extract of *Abutilon indicum* proves to be an efficient approach for identifying the phytochemical compounds present in this particular extract. Ethanol is a versatile solvent that can extract a wide range of both polar and non-polar compounds


CHLOROFORM EXTRACT--(CA) SICART 270623NAMITA-2

| Hit | REV | for | Compound Name | M.W. | Formula | CAS |
|---|---|---|---|---|---|---|
| 1 | 962 | 882 | OCTADECANOIC ACID | 284 | C18H36O2 | 57-11-4 |
| 2 | 959 | 923 | OCTADECANOIC ACID | 284 | C18H36O2 | 57-11-4 |
| 3 | 959 | 879 | OCTADECANOIC ACID | 284 | C18H36O2 | 57-11-4 |
| 4 | 957 | 933 | OCTADECANOIC ACID | 284 | C18H36O2 | 57-11-4 |
| 5 | 946 | 885 | EICOSANOIC ACID | 312 | C20H40O2 | 506-30-9 |
| 6 | 933 | 879 | PENTADECANOIC ACID | 242 | C15H30O2 | 1002-84-2 |
| 7 | 928 | 874 | TETRADECANOIC ACID | 228 | C14H28O2 | 544-63-8 |
| 8 | 926 | 859 | OCTADECANOIC ACID, 2-(2-HYDROXYETHOXY)ETHYL ESTER | 372 | C22H44O4 | 106-11-6 |
| 9 | 923 | 846 | N-HEXADECANOIC ACID | 256 | C16H32O2 | 57-10-3 |
| 10 | 915 | 874 | NONADECANOIC ACID | 298 | C19H38O2 | 646-30-0 |
| 11 | 910 | 851 | EICOSANOIC ACID | 312 | C20H40O2 | 506-30-9 |
| 12 | 907 | 850 | TRIDECANOIC ACID | 214 | C13H26O2 | 638-53-9 |
| 13 | 906 | 837 | TETRADECANOIC ACID | 228 | C14H28O2 | 544-63-8 |
| 14 | 902 | 855 | HEPTADECANOIC ACID | 270 | C17H34O2 | 506-12-7 |
| 15 | 901 | 852 | DOCOSANOIC ACID | 340 | C22H44O2 | 112-85-6 |
| 16 | 900 | 850 | N-HEXADECANOIC ACID | 256 | C16H32O2 | 57-10-3 |
| 17 | 894 | 845 | N-HEXADECANOIC ACID | 256 | C16H32O2 | 57-10-3 |
| 18 | 889 | 837 | PENTADECANOIC ACID | 242 | C15H30O2 | 1002-84-2 |
| 19 | 887 | 831 | TRIDECANOIC ACID | 214 | C13H26O2 | 638-53-9 |
| 20 | 886 | 815 | TRIDECANOIC ACID | 214 | C13H26O2 | 638-53-9 |

**Fig. 17: Phyto compound present in chloroform extract of *Abutilon indicum* using GC-MS Profiling (ADA: Antidiabetic activity)**

from plant material, making it particularly valuable for a comprehensive phytochemical analysis.

The GC-MS profiling of the ethanol extract from Abutilon indicum unveils a diverse array of bioactive compounds are shown in Figures 18 and 19 :

- **Flavonoids:** These are a miscellaneouscollection of plant secondary metabolites famous for their antioxidant and anti-inflammatory properties. They include compounds like Quercetin and kaempferol.
- **Alkaloids:** *Abutilon indicum* is known to contain alkaloids, such as vasicine, which have potential therapeutic effects, including bronchodilator and antimicrobial properties.
- **Tannins:** Tannins have antioxidant and anti-inflammatory properties and may contribute to the plant's traditional medicinal uses.
- **Saponins:** These compounds have diverse pharmacological activities, including potential antimicrobial and antifungal effects.
- **Terpenoids:** These compounds have various biological behaviors, together with antimicrobial, anti-inflammatory, and antioxidant property.
- **Phytosterols:** These compounds, akin to plant sterols, may have cholesterol-lowering and anti-inflammatory effects.

The ethanol extract of *Abutilon indicum* rich in such diverse phytochemical underscores the plant's medicinal value. It serves as a potential source for developing herbal medicines, dietary supplements, or functional foods. Further investigate is essential to elucidate the exact therapeutic reimbursement and applications of these compounds and their interactions within the plant's overall chemical profile[7,8].

## RESULTS AND DISCUSSION

In this systematic investigation, a comprehensive analysis was conducted employing Thin-Layer Chromatography (TLC) and High-Performance Thin-Layer Chromatography

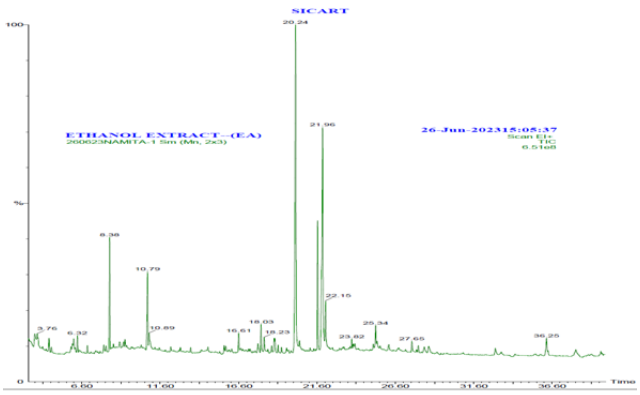



**Fig. 18: GC-MS analysis of ethanolic extract *Abutilon indicum***

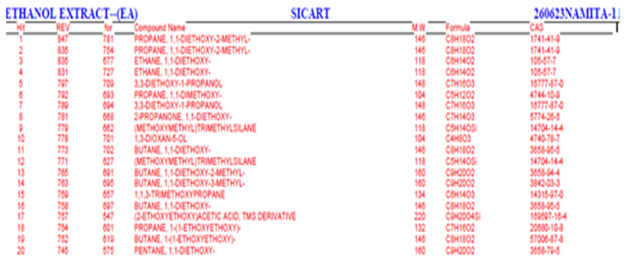



**Fig. 19: Phyto compound present in ethanolic extract of *Abutilon indicum* using GC-MS Profiling (ADA: Antidiabetic activity)**

(HPTLC) to determine bioactive compounds in various extracts of *Abutilon indicum*. The ethanolic extract (EA) exhibited distinct RF values of 0.16 for catechin, 0.57 for gallic acid, and 0.70 for quercetin. *Abutilon indicum*. (EA) demonstrated the highest percentages of these compounds: 48.87% for catechin, 27.45% for gallic acid, and 7.25% for quercetin.

The HPTLC process, robustly developed and validated, showcased clear bands and sharp peaks when applied to ethanolic extracts, allowing for the precise separation of bioactive compounds. Similar HPTLC methodologies were applied to chloroform extract (CA) and aqueous extract (AA) with RF values of 0.10, 0.36, and 0.54 for CA, and 0.087, 0.36, and 0.53 for AA, corresponding to catechin, gallic acid, and quercetin, respectively. Fingerprinting analysis confirmed the simultaneous presence of these compounds, emphasizing the utility of the method for quality control.

Statistical analysis substantiated the reliability and suitability of the HPTLC process for quantitative analysis, providing a cost-effective and accurate means of assessing the quality of herbal materials and formulations containing these bioactive compounds.

Further exploration of *Abutilon indicum* extracts using GC-MS revealed a diverse array of phytochemicals. The ethanolic extract contained over 20 compounds, including flavonoids, alkaloids, and terpenoids, indicative of its medicinal potential. Likewise, the chloroform and aqueous extracts each exhibited more than 20 compounds, with the chloroform extract featuring phytosterols, alkaloids, and terpenoids, suggesting suitability for lipid-based pharmaceuticals. The aqueous extract also displayed medicinal potential with its diverse phytochemical composition.

These findings collectively support the utilization of *Abutilon indicum* in herbal medicine and pharmaceutical formulations, underscoring the versatility of the extracts and their potential therapeutic applications.

## CONCLUSION

In conclusion, the study on *Abutilon indicum* revealed its diverse phytochemical composition through meticulous HPTLC analysis. The optimized method provided precise quantification of catechin, Gallic acid, and Quercetin, showcasing distinct Rf values. Notably, *Abutilon indicum* (EA) exhibited significant content of Catechin (48.87%), Quercetin (7.25%), and Gallic acid (27.45%) for antidiabetic activity. Fingerprinting analysis identified key compounds with specific Rf values, emphasizing the plant's chemical profile. Additionally, the aqueous extract, though less rich in non-polar compounds, contained valuable components like Flavonoids, tannins, and saponins, suggesting its potential in traditional medicine and functional foods. *Abutilon indicum* Emerges as a versatile resource with applications in modern pharmacology, traditional medicine, and functional foods. The study's insights into solvent choice for targeting specific bioactive compounds pave the way for further research to isolate and harness individual compounds for diverse health-related applications.

### *Acknowledgment*

I extend my sincere appreciation to Dr. Ravindra B. Patil, a professor at DCS's A. R. A. College of Pharmacy in Nagaon, Dhule, for his invaluable mentorship and unwavering support. Heartfelt gratitude is also extended to Professor Ravindra Nikam and the College of Pharmacy in Gondur, Dhule, for generously providing essential research facilities. Additionally, I would like to convey my thanks to Dr. A. V. Patil, the Principal of Prof. Ravindra Nikam College of Pharmacy in Gondur and Dhule, for their consistent encouragement and support throughout this endeavor.

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