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AN ANALYTICAL STUDY OF BHADRADARVADI GANA THROUGH HPTLC

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ABSTRACT

Ayurveda and herbal medicine systems are deeply rooted in nature-based formulations, derived from centuries of empirical knowledge. However, with the increasing global acceptance and demand for Ayurveda therapies, the need for scientific validation and quality assurance has become paramount. Modern analytical techniques play a pivotal role in the standardization of Ayurveda medicines, ensuring their safety, efficacy, and reproducibility without compromising classical authenticity. Standardization serves as a bridge between traditional Ayurveda wisdom and contemporary scientific approaches, making these formulations more credible and acceptable on a global scale. According to Ayurveda scholars, for any formulation to yield optimal therapeutic outcomes, it must undergo precise analytical evaluation. Most classical Ayurveda formulations, including Bhadradarvadi Gana, require validation using modern methodologies for broader clinical and commercial acceptance. Bhadradarvadi Gana is a traditional polyherbal formulation primarily used in Churna form for external application, especially in Upanaha Sweda (poultice fomentation therapy). This article focuses on the High-Performance Thin-Layer Chromatography (HPTLC) fingerprinting of Bhadradarvadi Gana as a step toward its standardization and scientific validation.

KEYWORDS: Bhadradarvadi Gana, Herbal drug, HPTLC fingerprinting.

1. INTRODUCTION

In today's interconnected and health-conscious world, wellness has become a global priority, leading to increased interest in natural and holistic healing systems. Among these, herbal medicines—especially those rooted in traditional practices like Ayurveda have gained significant recognition for their therapeutic efficacy, low toxicity, and minimal side effects. Over the past two decades, their acceptance has notably grown in Western countries, where a shift toward sustainable and integrative healthcare has fueled demand for plant-based, natural formulations.

Herbal medicines, derived from botanical, minerals, and select animal products, embody a unique intersection of ancient wisdom and evolving scientific validation. However, to ensure their safe and effective inclusion in contemporary healthcare systems, it is essential to implement stringent quality control and standardization practices. This includes authentication of raw materials, certification of source originality, evaluation of intermediate and final products, and screening for potential contaminants or harmful substances.

In this context, the present study focuses on Bhadradarvadi Gana, a classical polyherbal formulation commonly used in Ayurveda. Referenced in ancient Ayurveda texts and traditionally administered in Upanaha Sweda (poultice therapy), Bhadradarvadi Gana holds therapeutic relevance for musculoskeletal disorders. The study aims to scientifically validate and assess the stability of this formulation through advanced analytical tools—specifically High-Performance Thin-Layer Chromatography (HPTLC)—thereby aligning traditional Ayurveda principles with modern pharmacognostical standards and fostering global credibility in Ayurveda therapeutics.

2. MATERIALS AND METHODS

2.1 Collection, Identification and authentication of raw drugs

All raw materials used in this study were collected from Shree Akshar Pharmaceuticals, a GMP-certified Ayurveda pharmacy located in Ahmedabad, Gujarat. The raw drugs were carefully identified and authenticated to ensure their quality, purity, and compliance with Ayurveda pharmacognostical standards before being used in the formulation and analysis.

2.2 Ingredient of Bhadradarvadi gana[1,2]

Drug (Latin Name)	Rasa	Guna	Virya	Vipaka
Bhadradaru (Cedrus deodara Roxb. ex D.Don G.Don)	Tikta (Bitter), Katu, Kashaya (Astringent)	Laghu (Light), Ruksha (Dry), Tikshna (Sharp)	Ushna (Hot)	Katu (Pungent)
Tagar (Valeriana wallichii DC.)	Tikta, Madhur (Sweet), Katu	Snigdha (Unctuous), Ushna	Ushna	Katu
Kushta (Saussurea lappa (Decne.) Sch.Bip.)	Tikta, Madhur, Katu	Laghu, Ruksha, Tikshna	Ushna	Katu
Baladwaya (Sida cordifolia Linn. and Abutilon indicum (Linn.) Sweet)	Madhur	Guru, Snigdha Laghu, Snigdha	Sheeta (Cold)	Madhur
Bilva (Aegle marmelos Linn. Corrêa)	Tikta	Laghu, Ruksha	Ushna	Katu
Agnimantha (Premna integrifolia Linn.)	Tikta, Kashaya	Guru, Ruksha	Ushna	Katu
Shyonaka(Oroxylum indicum Linn Kurz)	Tikta, Katu	Laghu, Ruksha	Ushna	Katu
Patala (Stereospermum suaveolens Roxb DC).	Tikta, Kashaya	Guru, Snigdha	Shita	Katu
Gambhari (Gmelina arborea Roxb).	Tikta, Madhura	Guru, Snigdha	Shita	Madhura
Brihati (Solanum indicum Linn.)	Tikta, Katu	Guru, Snigdha	Ushna	Katu
Kantakari (Solanum xanthocarpum Schrad. & Wendl.)	Tikta, Katu	Laghu, Ruksha	Ushna	Katu
Gokshura (Tribulus terrestris Linn.)	Madhura, Tikta	Guru, Snigdha	Shita	Madhura
Shalaparni (Desmodium gangeticum Linn DC).	Tikta, Katu	Guru, Snigdha	Ushna	Katu
Prishnaparni (Uraria picta Desv).	Tikta, Kashaya	Guru, Snigdha	Ushna	Madhura

HPTLC finger printing[3]

HPTLC study done at Vasu Research Centre, GIDC, Makarpura, Vadodara. (VARS/RS/25/07/012) on 24/07/2025.

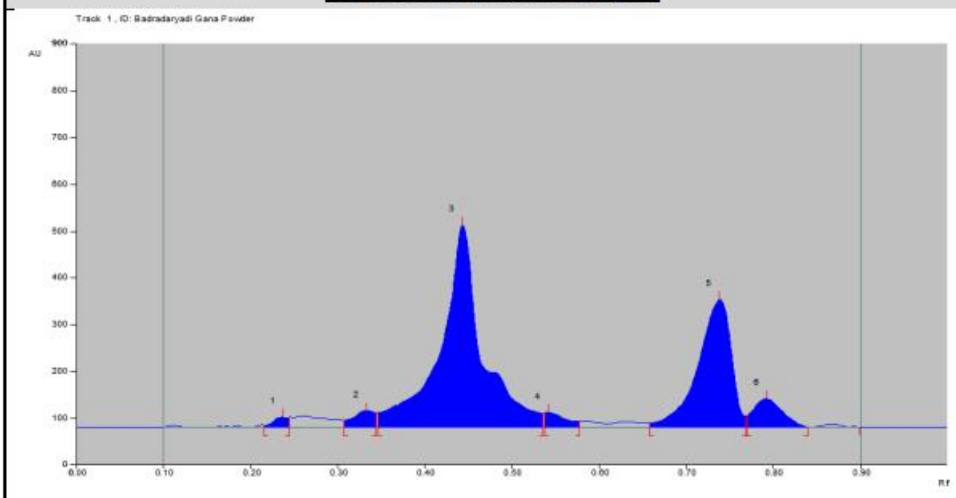
1g sample was weighed accurately in a conical flask. To it 10 mL methanol was added, reflux for 1 hour on water bath. Then, allowed to cool and filtered with the help of Whatman filter paper No. 1. The filtrate thus obtained was used for HPTLC fingerprinting.

Preparation of Spray reagent: [Anisaldehyde – sulphuric acid reagent][4]

0.5 mL Anisaldehyde is mixed with 10 mL Glacial acetic acid, followed by 85 mL Methanol and 5 mL Sulphuric acid (98 %).

Chromatographic Conditions	
Application Mode	CAMAG Linomat 5 - Applicator
Filtering System	Whatman filter paper No. 1
Stationary Phase	MERCK - TLC / HPTLC Silica gel 60 F_{254} on Aluminum sheets
Application (Y axis) Start Position	10 mm
Development End Position	80 mm from plate base
Sample Application Volume	5 µL
Distance Between Tracks	0.0 mm
Development Mode	CAMAG TLC Twin Trough Chamber
Chamber Saturation Time	30 minutes
Mobile Phase (MP)	Toluene: Ethyl acetate: Acetic acid (7: 3: 0.1 v/v)
Visualization	@ 254 nm, @ 366 nm and @ 540 nm (after derivatization)
Spray reagent	Anisaldehyde- Sulphuric acid reagent
Derivatization mode	CAMAG – Dip tank for about 1 minute
Drying Mode, Temp. & Time	TLC Plate Heater Preheated at 100± 5^0C for 3 minutes

HPTLC Chromatogram @ 254 nm



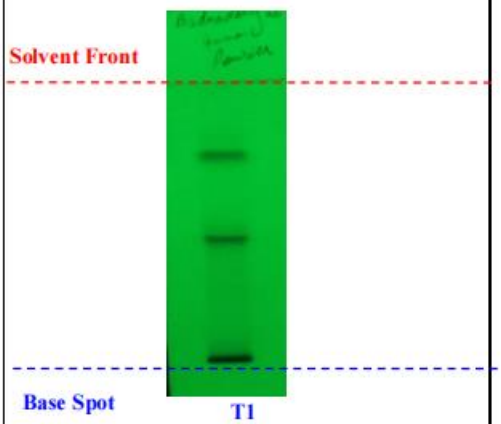
2D Chromatogram

$R_f$value

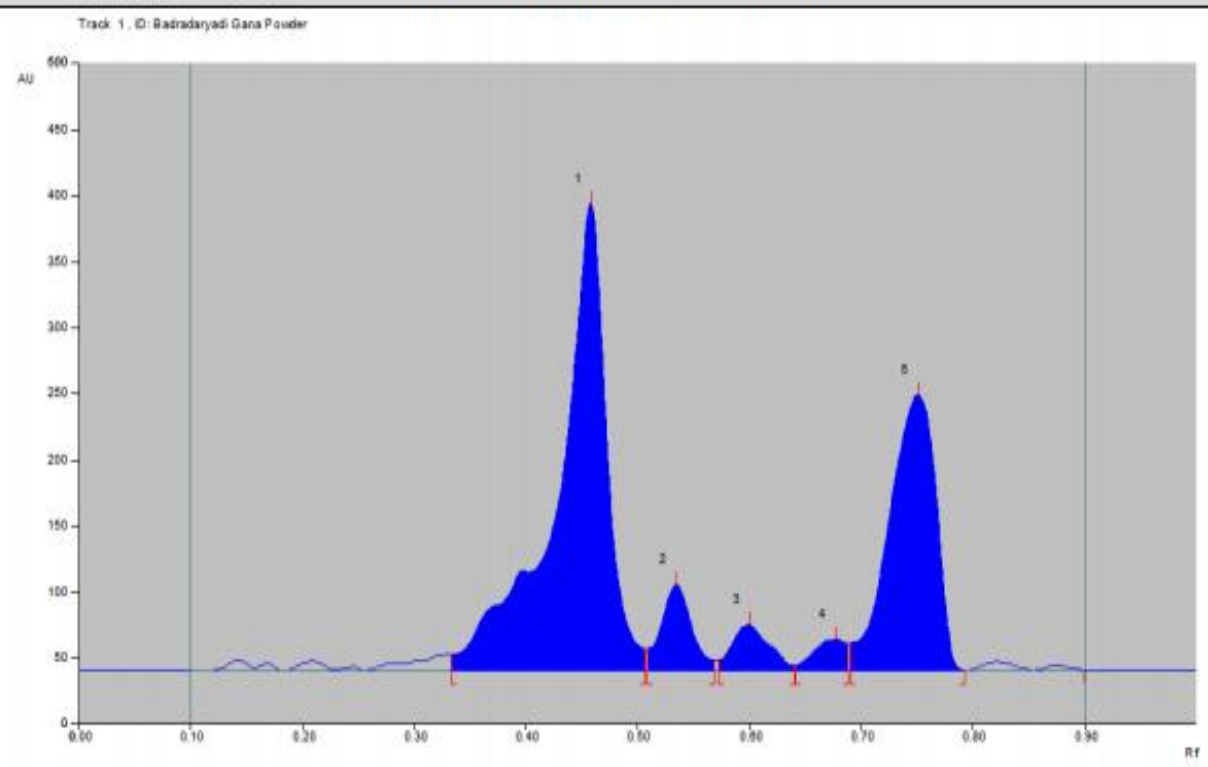
Spot No.	Track T1
1	0.24
2	0.33
3	0.44
4	0.54
5	0.74
6	0.79

Track T1: Badradaryadi Gana Powder

HPTLC Plate



HPTLC Chromatogram @ 540 nm



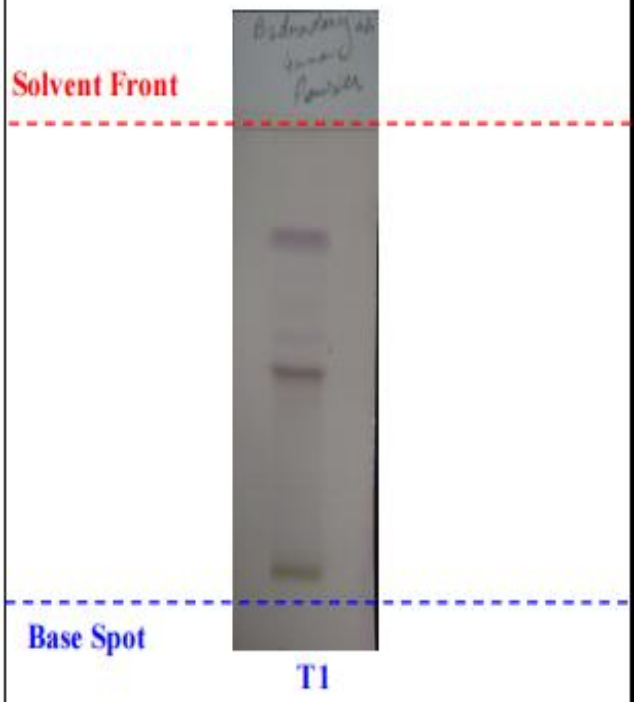
2D Chromatogram

R_f value

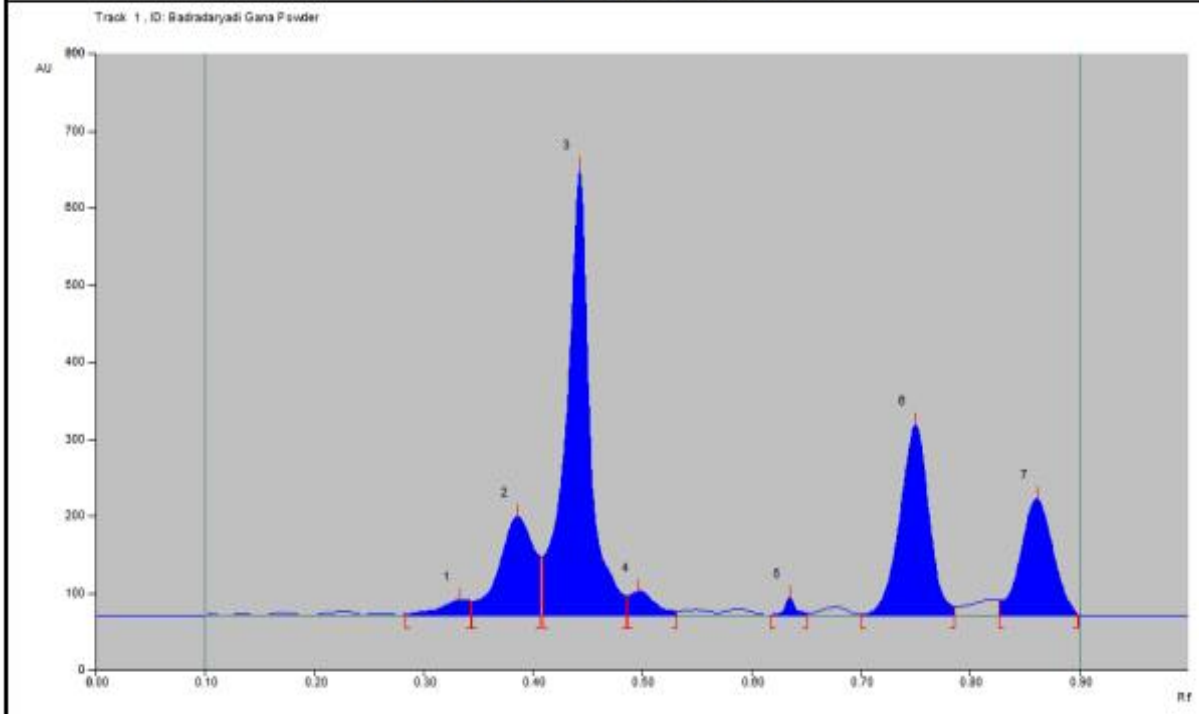
Spot No.	Track T1
1	0.44
2	0.54
3	0.60
4	0.68
5	0.74

Track T1: Badradaryadi Gana Powder

HPTLC Plate



HPTLC Chromatogram @ 366 nm



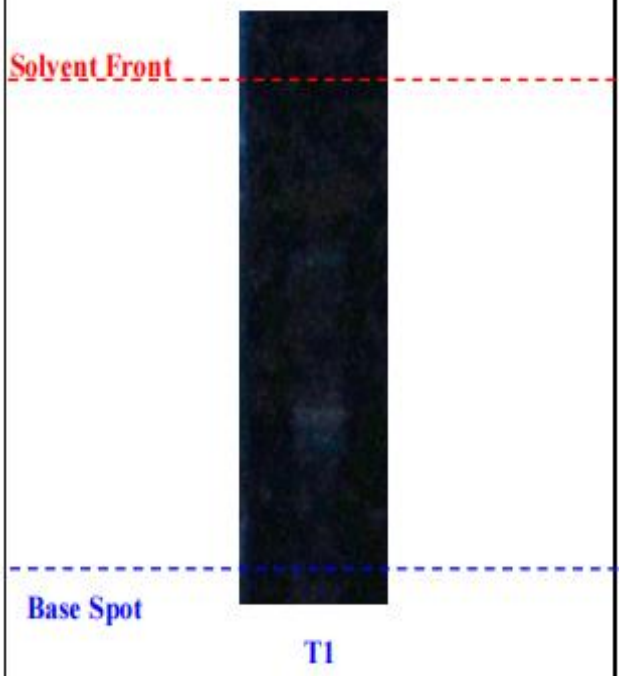
2D Chromatogram

R_f value

Spot No.	Track T1
1	0.33
2	0.39
3	0.44
4	0.50
5	0.64
6	0.74
7	0.86

Track T1: Badradaryadi Gana Powder

HPTLC Plate



RESULTS

Rf Values of Selected Ayurveda Drugs – HPTLC Summary

The following table provides Rf values for key Ayurveda herbs commonly used in classical formulations, as identified through High-Performance Thin Layer Chromatography (HPTLC). The Rf values vary based on solvent system, visualization mode (UV 254 nm, UV 366 nm, visible 540 nm), and the phytochemical composition of each plant.

Sr No.	Drug Name	Rf Value Range	Detection Mode	Major Compounds
1	Bhadradaru	0.20 – 0.26	254 nm	Sesquiterpenes, himachalol
2	Tagara	0.24 – 0.26	254 nm	Valerenic acid
		0.70 – 0.75	366 nm	Valerenic acid, alkaloids
		0.45 – 0.50	540 nm	Valepotriates
3	Kushta	0.22 – 0.26	254 nm	Costunolide, dehydrocostus lactone
		0.48 – 0.56	540 nm	Sesquiterpene lactones
		0.68 – 0.74	366 nm	Volatile lactones
4	Bala (Bala Dwaya)	0.31 – 0.36	254 nm	Ephedrine, vasicinone
		0.45 – 0.50	366 nm	Flavonoids
		0.58 – 0.66	540 nm	Saponins, sterols
5	Bilva	0.20 – 0.26	254 nm	Marmelosin, tannins
6	Agnimantha	0.42 – 0.48	366/540 nm	Terpenoids, sterols
7	Shyonaka	0.22 – 0.30	254 nm	Baicalein, flavonoids
8	Patala	0.40 – 0.48	366/540 nm	Iridoid glycosides
9	Gambhari	0.30 – 0.44	254/366 nm	Lignans, flavonoids
10	Brihati	0.32 – 0.38	254/366 nm	Solasodine, steroidal alkaloids
		0.72 – 0.76	366 nm	Volatile markers
11	Kantakari	0.33 – 0.40	254/366 nm	Steroidal alkaloids, solasonine
		0.72 – 0.78	366 nm	Glycoalkaloids
12	Gokshura	0.58 – 0.64	540 nm	Saponins, furostanol glycosides
		0.74 – 0.79	366 nm	Steroidal saponins
13	Shalaparni	0.30 – 0.36	254 nm	Isoflavones
		0.60 – 0.66	540 nm	Saponins, flavonoids
14	Prishniparni	0.50 – 0.64	540 nm	Triterpenoids, glycosides

DISCUSSION

The analytical evaluation of Bhadradarvadi Gana through High-Performance Thin-Layer Chromatography (HPTLC) offers crucial insights into the phytochemical authenticity and consistency of this classical Ayurveda formulation. Traditionally described in Ayurveda texts and widely applied in the form of Upanaha Sweda (poultice therapy), Bhadradarvadi Gana is primarily used for managing musculoskeletal conditions such as Vatakantaka (Calcaneal spur), Amavata (rheumatoid arthritis), Sandhivata (osteoarthritis), and other inflammatory disorders.

The formulation is composed of a diverse group of herbs, most of which exhibit Tikta and Katu Rasa, Ushna Virya, and Katu or Madhura Vipaka, aligning with its role as a Kapha (factor responsible for binding factor)-Vatahara and Ama-pachana formulation. The HPTLC fingerprinting process successfully identified unique and significant phytoconstituents in each of the major ingredients, reinforcing the compound's integrity and validating the traditional claims.

For instance, Bhadradaru exhibited sesquiterpenes and himachalol under 254 nm, consistent with its anti-inflammatory role. Tagar demonstrated the presence of valerenic acid and valepotriates under multiple detection wavelengths, supporting its calming and nervine actions. Similarly, Kustha revealed sesquiterpene lactones like costunolide, known for their potent anti-inflammatory and analgesic properties.

The Dashamoola group—an essential component in anti-inflammatory and rejuvenative formulations—also showed robust phytochemical markers. Bala Dwaya (Sida cordifolia and Abutilon indicum) revealed the presence of ephedrine, flavonoids, and other bioactives that support its anti-inflammatory and tissue-rejuvenating actions. Furthermore, constituents like Gambhari, Gokshura, and Prishniparni demonstrated lignans, glycosides, and steroidal saponins, confirming their role in strengthening tissues and maintaining fluid balance within inflamed or degenerated joints.

A significant outcome of this study was the establishment of Rf values for each individual herb, creating a distinct fingerprint for future reference. These Rf profiles are vital for standardization and quality control, ensuring batch-to-batch consistency, the detection of adulterants, and overall therapeutic efficacy of the formulation. Such phytochemical validation supports both regulatory compliance and clinical confidence.

Moreover, the use of Bhadradarvvadi Gana in Upanaha Sweda benefits from the synergistic action of heat and herbal application. The fomentation process aids in deeper tissue penetration of active phytochemicals, promotes local circulation, reduces stiffness, and facilitates Ama digestion at the site of inflammation. The effectiveness of the formulation in external applications, when validated through techniques like HPTLC, reaffirms the relevance of traditional formulations in modern therapeutic contexts.

This study underscores the growing importance of integrating traditional Ayurveda wisdom with modern analytical methodologies. By scientifically validating Bhadradarvadi Gana, it strengthens the foundation for evidence-based Ayurveda and contributes to bridging the gap between ethnomedicine and contemporary pharmacognosy.

CONCLUSION

HPTLC analysis not only authenticates the phytochemical composition of Bhadradarvadi Gana but also supports its continued clinical application, especially in the form of Upanaha Sweda. The study lays the groundwork for future research involving quantitative assays, stability testing, and pharmacological correlation, thereby enhancing its global credibility and therapeutic potential in integrative medicine.

Consent

It is not applicable.

Ethical Approval

It is not applicable.

ACKNOWLEDGEMENT

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