



# Resolving the Botanical Identity of the Ayurvedic Drug *Brahmadandi*: A Critical Comparative Review of *Tricholepis glaberrima* and *Echinops echinatus*

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## Abstract

**Background:** In the epistemological framework of Ayurveda, the term *Sandigdha Dravya* designates medicinal plants possessing controversial, ambiguous, or conflated botanical identities. *Brahmadandi* represents one such highly debated drug. Historically integrated into the Ayurvedic *Materia Medica* (*Nighantus*) post-10th century, its exact botanical source remains fiercely contested. Currently, two distinct xerophytic species of the Asteraceae family *Tricholepis glaberrima* DC. and *Echinops echinatus* Roxb. are interchangeably traded and administered as *Brahmadandi*. This unchecked substitution severely compromises clinical efficacy, particularly in aphrodisiac (*Vajikarana*) therapies, and disrupts pharmacopoeial standardization. **Methods:** A rigorous systematic review was executed in strict accordance with PRISMA guidelines. The classical methodology involved a critical hermeneutic analysis of major Ayurvedic *Samhitas*, *Nighantus*, and the Ayurvedic Pharmacopoeia of India (API) to extract etymological, pharmacodynamic (*Rasa Panchaka*), and therapeutic (*Karma*) data. Concurrently, a modern scientific review was conducted across PubMed, Scopus, and Web of Science, utilizing precise Boolean operators to collate contemporary data on the pharmacognosy, phytochemistry, and pharmacology of both botanical candidates. **Results:** Classical literature unequivocally indicates *Brahmadandi* for *Vajikarana* (aphrodisiac therapy), *Apasmara* (neurological disorders), and *Shopha* (inflammation). Modern pharmacological evaluations reveal that *Tricholepis glaberrima* demonstrates significant androgenic, spermatogenic, and antidepressant activities, perfectly corroborating classical claims. Conversely, *Echinops echinatus* exhibits potent anti-androgenic effects, reducing testosterone and inhibiting 5-alpha-reductase, rendering it efficacious for benign prostatic hyperplasia (BPH) but critically contraindicated as an aphrodisiac.

**Conclusion:** This critical comparative analysis definitively resolves the botanical identity of *Brahmadandi* in favor of *Tricholepis glaberrima* DC. The substitution with *Echinops echinatus* Roxb. constitutes a severe clinical hazard in reproductive therapeutics. *E. echinatus* aligns more accurately with the classical drug *Ustrakantaka*.

**Keywords-** *Brahmadandi*, *Tricholepis glaberrima* DC, *Echinops echinatus* Roxb., Ayurveda, *Sandigdha Dravya*

## 1. Introduction

The codification of medicinal plants in Ayurveda, systematically housed within the discipline of *Dravyaguna Vigyan* (Ayurvedic pharmacology and *Materia Medica*), represents one of the most sophisticated and enduring ancient systems of plant-based therapeutics. However, a profound challenge within this historical epistemological framework is the widespread phenomenon of *Sandigdha Dravya*, which translates to controversial or ambiguous drugs. The genesis of *Sandigdha Dravya* is multifactorial, rooted in the erosion of unbroken clinical lineages (*Guru-Shishya parampara*), the vast geographic and ecological diversity of the Indian subcontinent that necessitated regional botanical substitutions, and the inherent complexities of Sanskrit nomenclature. Often, a single Sanskrit synonym was applied to multiple botanicals possessing similar morphological traits (*Rupa*), pharmacological properties (*Guna*), or therapeutic actions (*Karma*). Over millennia, this linguistic overlap resulted in profound botanical confusion, challenging modern efforts to establish unified pharmacopoeial standards.

<sup>i</sup>The classical text *Bhavaprakasha Nighantu*, authored in the 16th century, highlights numerous such controversial entities, including critical herbs like *Rasna*, *Vacha*, and *Kushtha*, where multiple distinct botanical species are utilized interchangeably across different geographic zones. Among these contested botanicals, *Brahmadandi* stands as a quintessential and clinically urgent example. Conspicuously absent from the foundational ancient treatises known as the *Brihatrayi* (*Charaka Samhita*, *Sushruta Samhita*, and *Ashtanga Hridaya*), *Brahmadandi* was integrated into the Ayurvedic fold much later in history. Its definitive inclusion is traced to the *Nighantu* literature compiled between the 10th and 17th centuries, making its most prominent debut in Pandit Narahari's *Raja Nighantu*. Heralded in these medieval texts as a supreme *Vajikarana* (aphrodisiac), *Medhya* (nervine tonic), and a potent therapeutic agent for *Shopha* (inflammation) and *Apasmara* (neurological and psychiatric disorders), its integration into clinical practice has been widespread but botanically fractured.<sup>ii</sup>

Presently, a profound botanical dichotomy plagues the identity of *Brahmadandi*, oscillating almost exclusively between two species of the Asteraceae family: *Tricholepis glaberrima* DC. and *Echinops echinatus* Roxb.. While regional practices in Maharashtra, Karnataka, and Gujarat often source *T. glaberrima* (known locally as the Smooth Camel Thistle), raw drug markets in northern India and traditional Unani practitioners frequently supply *E. echinatus* (Indian Globe Thistle) under the same vernacular umbrella. This substitution transcends mere taxonomic pedantry; it represents a critical pharmacological divergence. The empirical application of an incorrect botanical source in complex polyherbal formulations can lead to diminished therapeutic outcomes or, more alarmingly, severe iatrogenic harm due to opposing endocrinological mechanisms.

The primary objective of this critical comparative review is to definitively resolve the botanical identity of the Ayurvedic drug *Brahmadandi*. By undertaking an exhaustive juxtaposition of the classical Ayurvedic literary corpus with contemporary pharmacognostical, phytochemical, and pharmacological evidence, this treatise aims to scientifically delineate the true botanical source of *Brahmadandi*, differentiate it clearly from its primary adulterant, and establish rigid, evidence-based parameters for its pharmacopoeial standardization.<sup>iii</sup>

## 2. Materials and Methods

To achieve a comprehensive, evidence-based resolution of this botanical controversy, the research methodology was structurally designed to integrate classical hermeneutic analysis with modern systematic review protocols, adhering strictly to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.

### 2.1. Classical Literary Search Strategy

The classical review necessitated a rigorous, structured hermeneutic analysis of primary Ayurvedic literature to trace the historical emergence, etymology, and therapeutic evolution of *Brahmadandi*. The methodology involved systematic manual screening of foundational texts, specifically utilizing the authoritative editions published by recognized institutions to ensure compliance with the Ayurvedic Pharmacopoeia of India (API) formats.

The search commenced with the *Samhita* period texts. An exhaustive screening was conducted through the *Charaka Samhita*, *Sushruta Samhita*, and *Ashtanga Hridaya* to confirm the absence or oblique presence of the drug, establishing its chronological entry into the *Materia Medica*. Subsequently, the core classical data was extracted from the *Nighantu* period texts, which serve as the primary repositories for later-era drugs. The comprehensive search included *Raja Nighantu* by Narahari Pandit, *Bhavaprakasha Nighantu* by Bhavamishra, *Kaiyadeva Nighantu*, *Dhanvantari Nighantu*, *Shaligram Nighantu*, and *Nighantu Adarsha*. Finally, the Ayurvedic Pharmacopoeia of India (API) was consulted to verify the officially recognized macroscopic and microscopic parameters, standard assay limits, and approved vernacular names for both *T. glaberrima* and *E. echinatus*.

Data extraction from these classical texts focused strictly on specific parameters: *Paryaya* (synonyms and etymology), *Rasa Panchaka* (Ayurvedic pharmacodynamics including taste, property, potency, and post-digestive effect), and *Rogaghnata* (specific disease indications and clinical actions).

### 2.2. Modern Scientific Database Search Strategy

To correlate classical Ayurvedic claims with contemporary scientific validation, an electronic literature search was executed across four major academic databases: PubMed, Scopus, Web of Science, and Google Scholar. The search covered literature published from database inception up to the present date, ensuring a comprehensive capture of all relevant modern research.

The search strategy employed advanced Boolean operators and targeted Medical Subject Headings (MeSH) to capture all relevant botanical, phytochemical, and pharmacological literature. The primary search strings utilized were:

1. ("Brahmadandi" OR "Utkantaka" OR "Ajadandi" OR "Sandigdha Dravya") AND ("Tricholepis glaberrima" OR "Echinops echinatus")
2. ("Tricholepis glaberrima") AND ("phytochemistry" OR "pharmacology" OR "pharmacognosy" OR "antidepressant" OR "aphrodisiac" OR "spermatogenesis" OR "cynaropicrin")
3. ("Echinops echinatus") AND ("phytochemistry" OR "pharmacology" OR "pharmacognosy" OR "anti-inflammatory" OR "anti-androgenic" OR "prostatic hyperplasia" OR "echinopsine")

The inclusion criteria were strictly defined. Articles were included if they provided primary empirical data on the macroscopic and microscopic authentication, extraction and isolation of secondary metabolites, in vitro cellular assays, or in vivo animal models regarding either *T. glaberrima* or *E. echinatus*. Systematic reviews, meta-analyses, and rigorous ethnobotanical surveys published in peer-reviewed, indexed journals were also included.

The exclusion criteria were equally stringent. Papers lacking proper botanical authentication or voucher specimen deposition, studies involving complex polyherbal formulations where the specific pharmacological effect of the target plant could not be isolated, non-English language publications, and unindexed articles from predatory journals were strictly excluded to maintain the academic rigor of the review.

Data extraction from the modern literature utilized a standardized template to capture taxonomy, geographical distribution, macroscopic features, microscopic tissue characteristics, major isolated phytochemicals (including alkaloids, flavonoids, and sesquiterpene lactones), specific experimental test models used (such as STZ-induced diabetes, testosterone-induced prostatic hyperplasia, or forced swim tests), and the ultimate pharmacological outcomes. This dual-pronged methodology allowed for a robust synthesis of ancient wisdom and modern biomedicine.<sup>iv</sup>

#### 4. Literary Review (Ayurvedic Perspective)

The epistemological journey of *Brahmadandi* in Ayurveda requires a deep linguistic and clinical dissection of classical texts. Because the drug is conspicuously absent from the foundational *Brihattrayi*, the burden of delineating its true identity falls entirely upon the highly descriptive *Nighantu* literature, which flourished during the medieval period of Indian medical history.

##### 4.1. Etymology and Synonyms (*Paryaya*)

In Ayurvedic *Dravyaguna Vigyan*, synonyms (*Paryaya*) are not mere alternative nomenclatures; rather, they are highly specific descriptors that encapsulate the morphological (*Swarupa*), pharmacological (*Guna*), or therapeutic (*Karma*) essence of the plant. A thorough analysis of the *Nighantus* reveals several key synonyms for *Brahmadandi* that provide crucial, albeit sometimes conflicting, clues to its physical identity.

The primary name *Brahmadandi* itself translates literally to "the staff of *Brahma*." In the Ayurvedic context, this nomenclature implies a plant with a prominent, erect, and unbranched central stalk (a *Danda*), denoting its physical strength and its corresponding capacity to act as a potent nervine and reproductive tonic (*Medhya* and *Vajikarana*). The term *Ajadandi* or *Ajaladandi* translates to "the staff of a goat" or implies a plant frequently grazed upon by goats, reflecting its ecological habitat in dry, arid grasslands and rocky soils.

Another critical morphological synonym encountered in the texts is *Kantakapatrafalaa*, which explicitly indicates a plant possessing prominent thorns (*Kantaka*) on both its leaves (*Patra*) and its fruits or flower heads (*Phala*). Furthermore, the synonym *Utkantaka* or *Ustrakantaka* emphasizes the extremely spinous nature of the plant, suggesting a botanical that is so heavily armed with thorns that it is primarily consumed by camels (*Ustra*). This particular synonym represents the nexus of the botanical confusion, as it heavily implies the morphology of the *Echinops* genus, which is notoriously spiny, creating a historical conflation between the two distinct species.

Regional vernacular names also provide significant ethnobotanical insight. In Gujarat, the drug is known as *Talakanto* or *Fusiyaroon*; in Bengal, it is referred to as *Chhaagaldandi* (goat's staff); and in Maharashtra, it is known as *Dahan* or *Bothamore*.

**Table 1: Synonyms of *Brahmadandi* mentioned across different *Nighantus***

| Synonym (Sanskrit)              | Meaning / Contextual Implication                                             | Referenced Classical Text(s)                                                                         |
|---------------------------------|------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|
| <i>Brahmadandi</i>              | "Staff of Lord Brahma"; denotes an erect stalk and supreme tonic properties. | <i>Raja Nighantu</i> , <i>Bhavaprakasha</i> , <i>Shaligram Nighantu</i> <sup>v</sup>                 |
| <i>Ajadandi / Ajaladandi</i>    | "Staff of a goat"; indicates habitat in arid grazing lands and rocky soils.  | <i>Raja Nighantu</i> <sup>vi</sup> , <i>Kaiyadeva</i> <sup>vii</sup> <i>Nighantu</i>                 |
| <i>Kantakapatrafalaa</i>        | Bearing thorns on both the leaves and the fruit/inflorescence.               | <i>Raja Nighantu</i> , <i>Nighantu</i> , <i>Adarsha</i> , <i>Dhanvantri Nighantu</i> <sup>viii</sup> |
| <i>Utkantaka / Ustrakantaka</i> | Extremely thorny; commonly eaten by camels ( <i>Ustra</i> ).                 | <i>Shodhal Nighantu</i> , <i>Bhavaprakasha</i>                                                       |
| <i>Kambu-vanamalini</i>         | Growing as a garland or spreading entity in the wild/forest.                 | <i>Raja Nighantu</i>                                                                                 |
| <i>Raktapushpi</i>              | Bearing red or purple colored flowers.                                       | <i>Shodhal Nighantu</i> <sup>ix</sup>                                                                |

#### 4.2. Ayurvedic Pharmacodynamics (*Rasa Panchaka*)

The therapeutic mechanism of any drug in Ayurveda is decoded through its *Rasa Panchaka*—the fivefold pharmacodynamic paradigm comprising *Rasa* (taste), *Guna* (physical properties), *Virya* (thermal potency), *Vipaka* (post-digestive biotransformation), and *Prabhava* (specific inexplicable action).

According to the broad consensus of the medieval lexicons, *Brahmadandi* is characterized predominantly by its *Tikta* (bitter) and *Katu* (pungent) *Rasa*. In Ayurvedic pharmacology, the *Tikta Rasa* is composed of the *Akasha* (ether) and *Vayu* (air) *Mahabhutas* (elements), rendering it highly effective at clearing micro-channels (*Srotas*), digesting metabolic toxins (*Ama*), and reducing excessive moisture in the tissues. It possesses *Laghu* (light) and *Ruksha* (dry) *Gun*as, properties that allow the drug to be rapidly absorbed and penetrate deep into the *Dhatus* (tissues).

The thermal potency (*Virya*) of *Brahmadandi* is distinctly *Ushna* (hot), and its post-digestive effect (*Vipaka*) is *Katu* (pungent). In terms of *Dosha Karma* (humoral action), the combination of *Ushna Virya* and *Katu Vipaka* acts as a potent pacifier of aggravated *Kapha* and *Vata doshas* (*Kaphavatashamaka*). This specific pharmacodynamic profile makes the drug highly efficacious in pathological conditions characterized by sluggish metabolism, inflammation, and neurological blockages (*Srotorodha*).

#### 4.3. Classical Therapeutic Indications (*Karma and Rogaghnata*)

Therapeutically, the *Nighantus* are virtually unanimous in highlighting *Brahmadandi* as a superior *Vrishya* (aphrodisiac) and *Vajikarana* agent. It is specifically indicated in the management of *Shukrakshaya* (oligospermia) and *Klaibya* (erectile dysfunction and male impotence). The *Vaidyamanorama*, specifically in its *Guhyarogadhikar* chapter, outlines precise protocols for both the internal administration and local application of *Brahmadandi* juice mixed with honey to enhance sexual vitality and treat localized genitourinary disorders.

Beyond reproductive therapeutics, the texts strongly indicate *Brahmadandi* for *Apasmara* (epilepsy), *Bhramavata* (vertigo and psychiatric/neurological disorders), *Shopha* (edema and systemic inflammation),

and various forms of *Kustha* (intractable dermatological disorders, including leucoderma and eczema). The ability of the drug to act as a *Medhya* (nervine tonic) aligns with its application in treating exhaustion and neurological deficits.<sup>x</sup>

**Table 2: Rasa Panchaka and Karma of Brahmadandi according to major classical texts**

| Parameter                       | Classical Descriptor                                                                                          | Physiological / Therapeutic Implication                                                                  |
|---------------------------------|---------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|
| <b>Rasa</b> (Taste)             | <i>Tikta</i> (Bitter), <i>Katu</i> (Pungent)                                                                  | Clears <i>Srotas</i> (channels), digests <i>Ama</i> (toxins), stimulates metabolic fire ( <i>Agni</i> ). |
| <b>Guna</b> (Properties)        | <i>Laghu</i> (Light), <i>Ruksha</i> (Dry)                                                                     | Rapid absorption, counteracts the heavy/unctuous pathology of <i>Kapha</i> .                             |
| <b>Virya</b> (Potency)          | <i>Ushna</i> (Hot)                                                                                            | Promotes vasodilation, neuro-stimulation, and pacifies <i>Vata</i> .                                     |
| <b>Vipaka</b> (Post-digestive)  | <i>Katu</i> (Pungent)                                                                                         | Aids in cellular metabolism and reduces pathological fluid retention.                                    |
| <b>Doshaghnata</b>              | <i>Kapha-Vata Shamaka</i>                                                                                     | Balances cold, heavy, and erratic bio-energies in the body.                                              |
| <b>Main Karma</b>               | <i>Vajikarana</i> , <i>Vrishya</i> , <i>Medhya</i> , <i>Shothahara</i>                                        | Potent aphrodisiac, boosts spermatogenesis, brain tonic, anti-inflammatory.                              |
| <b>Rogaghnata</b> (Indications) | <i>Klaibya</i> (Impotence), <i>Apasmara</i> (Epilepsy), <i>Shopha</i> (Edema), <i>Kustha</i> (Skin diseases). | Applied extensively in male infertility, psychiatric disorders, and dermatoses.                          |

## 5. Botanical and Pharmacognostical Evaluation

The primary driver behind the *Sandigdha Dravya* status of *Brahmadandi* is the superficial macroscopic and morphological similarity between *Tricholepis glaberrima* and *Echinops echinatus*. Both are robust, thorny, arid-region plants belonging to the Asteraceae family. However, a rigorous botanical, macroscopic, and microscopic evaluation unequivocally separates the two species, providing the foundational evidence required to resolve their identities.

### 5.1. Taxonomy and Geographical Distribution

***Tricholepis glaberrima* DC.** belongs to the tribe Cardueae within the immense Asteraceae family. The generic nomenclature *Tricholepis* is derived from the Greek terms *thrix* or *trichos* (meaning hair) and *lepis* (meaning scale). Crucially, the specific epithet *glaberrima* is derived from the Latin root *glaber*, meaning "completely bald" or "supremely smooth," directly referencing the distinct lack of hairs or pubescence on the stem and leaves of this species. It is an endemic species to the tropical and subtropical hilly regions of the Indian subcontinent, prominently distributed across the Western Ghats, the Konkan region, the Deccan plateau, Rajasthan (specifically Mount Abu), and central India.

***Echinops echinatus* Roxb.** also belongs to the Asteraceae family. The generic name *Echinops* originates from the Greek word *echinos*, translating to hedgehog or sea urchin, perfectly indicative of its extremely spiny, spherical flower heads. The specific epithet *echinatus* simply translates to "prickly". Unlike *T.*

*glaberrima*, this xerophytic annual herb boasts a much wider distribution across the desert and semi-arid regions of India, Pakistan, Afghanistan, Sri Lanka, and the Mediterranean basin.

## 5.2. Macroscopic Comparison

*T. glaberrima* is a stout, erect annual herb reaching up to 1 meter in height. True to its taxonomic namesake, its stem and leaves are entirely glabrous they are smooth, shiny, and completely devoid of cottony hairs or pubescence. The leaves are sessile, linear-lanceolate, and punctate, with spinous-serrate margins. The inflorescence consists of small, solitary, ovoid flower heads (approximately 6-8 mm long) that bloom in a distinct purple color. A defining macroscopic feature is the pappus, which is copious, yellowish-brown, rigid, and notably shorter than the faintly ribbed, oblong achenes.

In stark morphological contrast, *E. echinatus* is characterized by a highly branched, short, and stout architecture, heavily covered in a prominent white, cottony pubescence. The leaves are arranged alternately, are deeply pinnatifid, pale green above, and densely woolly beneath, armed with formidable spines that frequently reach up to 2.5 cm in length. The flower heads are unmistakable and serve as a primary diagnostic feature: they are compact, solitary, perfectly spherical (globose) white or pale purple balls measuring 3-5 cm across. These globose heads are surrounded by strong, rigid white bristles resembling pappus hairs, while the actual achenes are obconic and densely villous.<sup>xi</sup>

## 5.3. Microscopic and Histological Characteristics

Pharmacognostical microscopy reveals definitive diagnostic cellular structures that allow for the absolute authentication of raw drug powders in the market, effectively preventing adulteration.

For *T. glaberrima*, the transverse section (TS) of the stem exhibits a single-layered epidermis comprised of thick rectangular cells covered by a prominent cuticle. It features both covering (uniseriate) trichomes composed of 4-5 thick-walled cells, and glandular trichomes with multicellular stalks and bicellular heads. The cortex is relatively narrow, and the vascular bundles are arranged radially in a continuous band with distinct spiral, reticulate, and pitted xylem thickenings. A massively well-developed, large parenchymatous central pith is a highly characteristic feature. Powder microscopy further reveals paracytic stomata, and fluorescence analysis of the methanolic extract shows strong fluorescent activity under UV light at 254 nm and 365 nm, indicative of high phenolic and flavonoid content.

The root and stem microscopy of *E. echinatus* presents an entirely different histological profile. The TS of the mature root shows an outermost periderm (6-8 layers thick) that replaces the epidermis, followed by a wide, homogenous parenchymatous cortex containing prominent and diagnostic oil globules. The vascular cylinder features multiseriate medullary rays (2-4 layers wide) extending deeply into the phloem, with thick, lignified, pitted vessels and abundant xylem fibers. The leaf TS highlights anomocytic stomata and distinct multicellular stellate (star-shaped) hairs, which are entirely absent in the simple uniseriate trichome profile of *Tricholepis*.

Table 3 provides a highly detailed side-by-side comparison of these features to clearly delineate the genuine source from the substitute.<sup>xii</sup>

**Table 3: Comparative Botanical, Macroscopic, and Microscopic Features**

| Diagnostic Feature              | <i>Tricholepis glaberrima</i> DC.                                                | <i>Echinops echinatus</i> Roxb.                                                         |
|---------------------------------|----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| <b>Habit &amp; Architecture</b> | Erect, stout, slender central stem.                                              | Highly branched from the base, low-lying shrub.                                         |
| <b>Stem Surface</b>             | Entirely <b>glabrous</b> (smooth, shiny, hairless).                              | Heavily covered in <b>white cottony pubescence</b> .                                    |
| <b>Leaf Morphology</b>          | Linear-lanceolate, sessile, spinous-serrate margins, smooth surfaces.            | Deeply pinnatifid, densely woolly beneath, armed with long sharp spines (up to 2.5 cm). |
| <b>Inflorescence (Heads)</b>    | Small, ovoid heads (6-8 mm); purple florets; solitary.                           | Large, spherical (globose) balls (3-5 cm); white/pale purple; extremely spiny.          |
| <b>Achene &amp; Pappus</b>      | Oblong, faintly ribbed achene; copious yellowish-brown rigid pappus.             | Obconic, densely villous achene; short, brush-like yellowish pappus.                    |
| <b>Trichomes (Microscopic)</b>  | Simple, uniseriate covering hairs and glandular trichomes with bicellular heads. | Multicellular stellate (star-shaped) hairs and long cottony fibers.                     |
| <b>Stem/Root Histology</b>      | Continuous radial vascular band; massive parenchymatous central pith.            | Multiseriate medullary rays; prominent diagnostic oil globules in the cortex.           |
| <b>Stomatal Type</b>            | Paracytic stomata.                                                               | Anomocytic stomata.                                                                     |

**5.4. Section Conclusion:** Based purely on botanical taxonomy, morphological architecture, and strict translation of the Sanskrit descriptors, *Tricholepis glaberrima* perfectly aligns with the concept of an erect, smooth "staff" (*Brahmadandi*). Conversely, the highly pubescent, heavily spined, spherical morphology of *Echinops echinatus* is definitively incongruent with *Brahmadandi* and flawlessly matches the classical descriptions of *Ustrakantaka* (Camel's Thistle).

## 6. Phytochemistry and Modern Pharmacological Review<sup>xiii</sup>

To scientifically bridge the ancient Ayurvedic claims with contemporary biomedicine, an extensive review of the secondary metabolites and the precise pharmacological mechanisms of both plants is essential. This modern data ultimately serves as the definitive arbiter in resolving the clinical controversy.

### 6.1. Phytochemical Profiling<sup>xiv</sup>

***Tricholepis glaberrima*:** Extensive phytochemical investigations of the aerial parts, stem, and roots of *T. glaberrima* have yielded a rich, diverse array of flavonoids, phytosterols, triterpenoids, and critically, sesquiterpene lactones. The most significant pharmacological marker isolated from this plant is the sesquiterpene lactone **cynaropicrin**. Cynaropicrin is a guaianolide synthesized via the mevalonate pathway, characterized by a gamma-butyrolactone ring, and is highly valued in modern pharmacology for

its potent anti-inflammatory action achieved via the suppression of NF- $\kappa$ B pathways and cytokine release. The plant also contains significant quantities of flavonoids, notably quercetin and rutin, which contribute to its robust free-radical scavenging abilities. Furthermore, triterpenoids such as betulin, and unique phytosterols like stigmast-22-en-3-ol and spinasterol, are abundantly present, contributing to the plant's anabolic and neuroprotective profiles.

***Echinops echinatus*:** The chemical profile of *E. echinatus* is distinctly different, characterized by the presence of unique quinoline alkaloids and highly specialized thiophene derivatives. The major alkaloids isolated from the aerial parts include **echinopsine**, echinopsidine, and echinozolinone. Thiophenes, which are sulfur-containing heterocyclic compounds, are a chemotaxonomic marker of the *Echinops* genus and impart significant antimicrobial, antifungal, and pesticidal properties. The plant also yields various phenolic compounds and flavanones, notably apigenin, apigenin-7-O-glucoside, echinacin, and echinaticin, along with the potent anti-inflammatory triterpenoid taraxasterol acetate.<sup>xv</sup>

**Table 4: Major Phytochemicals Isolated from *T. glaberrima* and *E. echinatus***

| Plant Species                        | Major Chemical Classes                                                 | Key Isolated Compounds & Markers                                                        |
|--------------------------------------|------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| <b><i>Tricholepis glaberrima</i></b> | Sesquiterpene Lactones, Flavonoids, Triterpenoids, Phytosterols        | Cynaropicrin, Trichololide, Quercetin, Rutin, Betulin, Spinasterol, Stigmast-22-en-3-ol |
| <b><i>Echinops echinatus</i></b>     | Quinoline Alkaloids, Polyacetylene Thiophenes, Flavones, Triterpenoids | Echinopsine, Echinopsidine, Apigenin, Echinacin, Echinaticin, Taraxasterol acetate      |

## 6.2. Modern Pharmacological Evaluation

The pharmacological dichotomy between these two plants, particularly regarding their effects on the mammalian reproductive system, is the most crucial finding of this review. This data definitively resolves the clinical controversy surrounding their interchangeable use.

**1. Reproductive Pharmacology (The Vajikarana Controversy):**<sup>xvi</sup> Classical Ayurvedic texts mandate that *Brahmadandi* is a supreme *Vajikarana* (aphrodisiac) agent, utilized to cure *Klaibya* (impotence) and build *Shukra dhatu* (reproductive tissue). Modern in vivo studies on *Tricholepis glaberrima* robustly validate this ancient claim. The administration of methanolic extracts of *T. glaberrima* (at doses of 200 mg/kg body weight) in sexually active male rat models resulted in a profound enhancement of sexual behavior. This was characterized by a statistically significant increase in intromission latency (IL) and mounting latency (ML). Furthermore, testicular histology demonstrated a marked proliferation of the seminiferous epithelium, thereby favoring and accelerating spermatogenesis. The observed increase in overall body weight and reproductive organ weight in the treated animal models confirms the presence of potent anabolic and androgenic (testosterone-boosting) properties. Therefore, the pharmacological mechanism of *T. glaberrima* perfectly mimics the classical requirements of a *Vajikarana* drug.

Conversely, *Echinops echinatus* exhibits the exact opposite pharmacological effect on the reproductive system. Research investigating the terpenoid and lipid fractions of *E. echinatus* roots in male rats demonstrated profound **anti-fertility and anti-androgenic effects**. Treatment regimens resulted in a highly significant decrease in the weight of reproductive organs (including the testes, epididymis, seminal vesicles, and ventral prostate). Biochemical analysis revealed a sharp decline in serum testosterone levels

and an inhibition of spermatogenesis, characterized by severely reduced sperm motility and sperm density. Because of this powerful anti-androgenic mechanism—which includes potent 5-alpha-reductase inhibitory activity *E. echinatus* has been proven highly effective in animal models for the treatment of testosterone-induced Benign Prostatic Hyperplasia (BPH). While highly beneficial for shrinking hypertrophic prostatic tissue, administering *E. echinatus* as an aphrodisiac would cause severe clinical failure, directly contradicting and antagonizing the *Vajikarana* requirement of *Brahmadandi*.

**2. Neurological and Psychiatric Pharmacology (*Apasmara* & *Medhya*):** The classical texts indicate *Brahmadandi* for psychiatric and neurological conditions (*Apasmara*). Modern behavioral models utilizing the Forced Swim Test (FST) and Tail Suspension Test (TST) showed that extracts of *T. glaberrima* act as reversible monoamine oxidase (MAO) inhibitors. By inhibiting MAO, the extract significantly elevates central serotonin (5-HT) and catecholamine (dopamine, norepinephrine) levels in the brain, exerting a potent antidepressant effect. This neurochemical modulation provides a flawless modern biomedical rationale for its traditional use as a *Medhya* (nervine tonic).

**3. Anti-inflammatory and Hepatoprotective Actions (*Shopha*):** Both plants exhibit notable anti-inflammatory actions (*Shothahara*), but they achieve this via entirely different molecular pathways. The sesquiterpene lactones (specifically cynaropicrin) present in *T. glaberrima* inhibit the NF-κB pathway, effectively reducing macrophage activation and pro-inflammatory cytokine release, validating its use in resolving *Shopha* (edema). *E. echinatus* relies on its triterpenoid taraxasterol acetate and the alkaloid echinopsine to directly inhibit COX-1 and COX-2 enzymes, effectively reducing carrageenan- and formaldehyde-induced paw edema in murine models. Both plants also demonstrate excellent hepatoprotective capabilities by lowering SGOT, SGPT, and ALP levels in CCl<sub>4</sub>-intoxicated animal models, preventing hepatic necrosis. <sup>xvii</sup>, <sup>xviii</sup>, <sup>xix</sup>

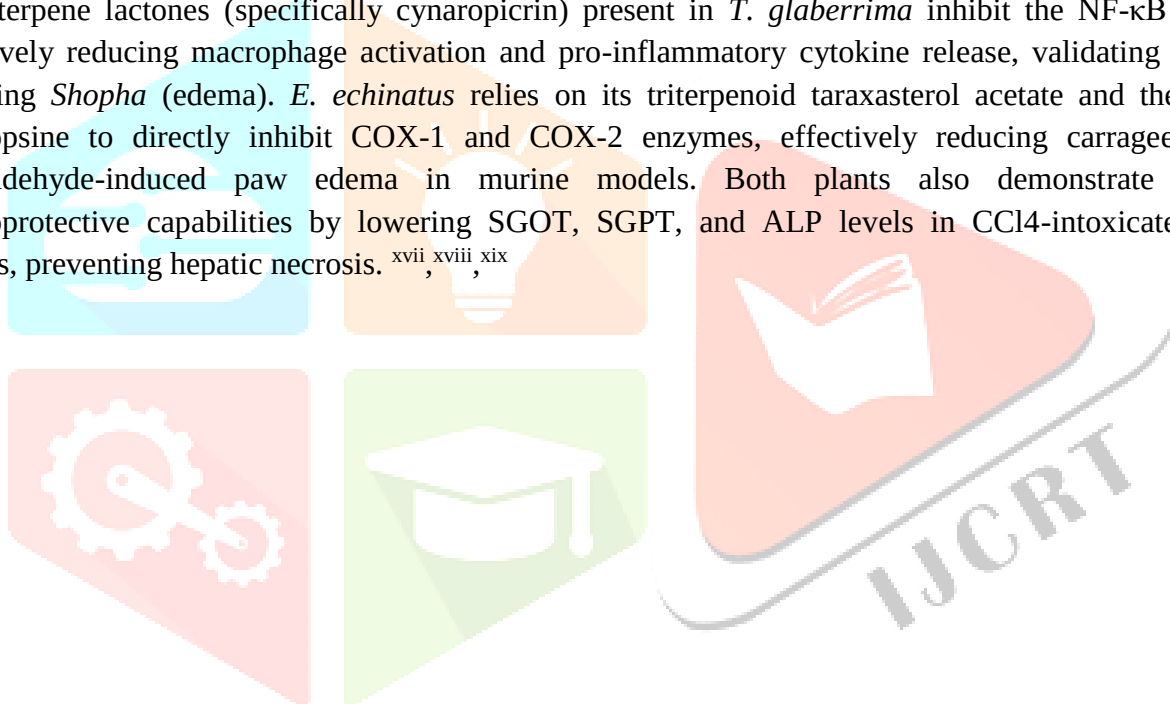


Table 5: Summary of pharmacological activities, test models used, and key outcomes

| Plant                | Pharmacological Activity         | Test Model / Assay Used                  | Key Outcomes & Molecular Mechanism                                                               | Correlated Ayurvedic Karma                                                      |
|----------------------|----------------------------------|------------------------------------------|--------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|
| <i>T. glaberrima</i> | Aphrodisiac / Androgenic         | Male Wistar rats; Mating behavior assays | ↑ Mounting/intromission latency, ↑ spermatogenesis, rapid proliferation of seminiferous tubules. | <i>Vajikarana</i> , <i>Vrishya</i> (Boosts fertility/libido)                    |
| <i>T. glaberrima</i> | Antidepressant / Nervine         | FST & TST in murine models               | MAO inhibition; ↑ Central serotonin (5-HT) and catecholamines.                                   | <i>Medhya</i> , <i>Apasmara-hara</i> (Nervine tonic)                            |
| <i>T. glaberrima</i> | Anti-inflammatory                | In vitro macrophage cellular assays      | Sesquiterpene lactones (cynaropicrin) inhibit NF-κB pathway; ↓ inflammatory cytokines.           | <i>Shothahara</i> (Anti-edema)                                                  |
| <i>E. echinatus</i>  | Anti-androgenic / Anti-fertility | Testosterone-induced BPH in male rats    | ↓ Serum testosterone, ↓ prostate weight, ↓ sperm density; potent inhibition of 5-α-reductase.    | <b>Contraindicated</b> as <i>Vrishya</i> . Useful in <i>Mutrakrichra</i> (BPH). |
| <i>E. echinatus</i>  | Anti-inflammatory / Analgesic    | Carrageenan paw edema; Eddy's hot plate  | Taraxasterol acetate inhibits COX-1/COX-2 enzymes; significant pain and swelling reduction.      | <i>Shothahara</i> , <i>Vedanasthapana</i> (Analgesic)                           |
| <i>E. echinatus</i>  | Hepatoprotective                 | CCl4-intoxicated rabbits                 | Reinstatement of normal SGPT, SGOT, and ALP levels; limits severe hepatic necrosis.              | <i>Yakrituttejaka</i> (Liver stimulant)                                         |

## 7. Discussion

The persistence of the *Sandigdha Dravya* phenomenon within Ayurvedic practice poses a systemic, critical risk to the reliability, safety, and ultimate globalization of this traditional medical system. The botanical confusion surrounding the identity of *Brahmadandi* represents a profound case study wherein linguistic and morphological ambiguities have led to the dangerous cross-substitution of two botanicals with diametrically opposed endocrinological effects.

A holistic synthesis of the classical literary evidence points toward a plant that is completely glabrous (smooth), structurally erect like a staff (*Dandi*), thorny on its leaves and fruits (*Kantakapatrafalaa*), and possessing highly potent aphrodisiac (*Vajikarana*) and nervine (*Medhya*) properties. Taxonomically and macroscopically, *Tricholepis glaberrima* aligns seamlessly with these historical descriptors. The Latin epithet *glaberrima* explicitly confirms its smooth, hairless nature, perfectly mirroring the classical observations of an unbranched, smooth staff. Conversely, *Echinops echinatus* is morphologically incongruent with the primary structural descriptors of *Brahmadandi*. It is densely covered in a white cottony pubescence and grows as a highly branched, low-lying shrub, entirely lacking the architecture of an erect staff. While it shares the spiny characteristics (*Kantaka*), it is far more likely that *E. echinatus* is the true botanical source for the distinct Ayurvedic drug *Ustrakantaka* or *Utkantaka* (Camel's Thistle)—a plant classically prescribed for *Ashmari* (calculus/urinary stones) and *Mutrakrichra* (urinary tract disorders). This specific identification theory is profoundly validated by modern pharmacology: the proven ability of *E. echinatus* to shrink prostatic tissue via 5-alpha-reductase inhibition provides a flawless, mechanistic scientific rationale for its traditional efficacy in relieving lower urinary tract symptoms, which were commonly diagnosed in ancient times as *Mutrakrichra*.

However, the most definitive and irrefutable resolution to this controversy lies in the reproductive pharmacology of the two species. The core therapeutic identity of *Brahmadandi* in the *Nighantu* literature is its celebrated status as a premier *Vajikarana* dravya. *T. glaberrima* has been empirically proven to exhibit powerful androgenic properties, stimulating the seminiferous epithelium, increasing body weight, and dramatically boosting mating behaviors and spermatogenesis. It fulfills the classical mandate unequivocally. *E. echinatus*, on the other hand, exerts a potent anti-androgenic, anti-fertility effect. It physically shrinks the testes, lowers serum testosterone, and depletes sperm density and motility. To substitute *T. glaberrima* with *E. echinatus* in an aphrodisiac formulation—a common occurrence in the current raw drug market is to inadvertently administer a chemical castration agent to a patient actively seeking fertility treatment. This extreme iatrogenic risk underscores the absolute necessity of rigorous pharmacognostical authentication in Ayurvedic manufacturing.<sup>xx</sup>

**Gaps in Current Research and Future Scope:** While pre-clinical in vitro and in vivo studies have elegantly mapped the pharmacological mechanisms of both plants, robust, double-blind, placebo-controlled human clinical trials remain starkly absent from the literature. Future research must urgently prioritize clinical evaluations of *T. glaberrima* standardized extracts (specifically standardized to cynaropicrin and spinasterol content utilizing HPTLC fingerprinting) for the treatment of idiopathic oligospermia and mild-to-moderate clinical depression. Furthermore, *E. echinatus* demands fast-tracked clinical trials as an alternative herbal therapeutic for Benign Prostatic Hyperplasia (BPH). Clinical trials directly comparing the efficacy and side-effect profile of *E. echinatus* root extracts to synthetic 5-alpha-reductase inhibitors like Finasteride could position this plant as a major breakthrough in urological phytomedicine.

## 8. Conclusion

Through an exhaustive, critical comparative synthesis of classical Ayurvedic *Dravyaguna* literature and contemporary scientific data, this review unequivocally resolves the botanical identity of the controversial drug *Brahmadandi*. The true, authentic botanical source of *Brahmadandi* is definitively identified as *Tricholepis glaberrima* DC. (Family: Asteraceae). This species perfectly aligns with the historical morphological descriptors and empirically validates the classical *Vajikarana* (aphrodisiac) and *Medhya* (nervine) indications required of the drug.

The widespread substitution, adulteration, or conflation of *Brahmadandi* with *Echinops echinatus* Roxb. is erroneous and clinically hazardous. *E. echinatus* possesses potent anti-androgenic and anti-fertility properties that directly antagonize and negate the intended therapeutic outcomes of *Brahmadandi*. *E. echinatus* should instead be formally recognized, reclassified, and standardized in the Ayurvedic pharmacopoeia as *Ustrakantaka*, reserved strictly for the management of prostatic hypertrophy (*Mutrakrichra*) and associated urinary tract disorders. Strict pharmacognostical vigilance and routine HPTLC fingerprinting—targeting cynaropicrin for *T. glaberrima* and echinopsine for *E. echinatus* must be enforced by regulatory bodies and the herbal pharmaceutical industry to ensure patient safety and preserve the clinical integrity of Ayurvedic formulations.

## 9. References

- <sup>i</sup> Bhavamishra. (2015). *Bhavaprakasha Nighantu* (K. C. Chunekar, Trans. & Ed.). Chaukhambha Bharati Academy. (Guduchyadi Varga, Verses 25-27).
- <sup>ii</sup> Charaka. (2014). *Charaka Samhita* (P. V. Sharma, Trans.). Chaukhambha Orientalia. (Sutra Sthana, Chapter 4).
- <sup>iii</sup> Sushruta. (2012). *Sushruta Samhita* (K. R. S. Murthy, Trans.). Chaukhambha Orientalia. (Sutra Sthana, Chapter 38).
- <sup>iv</sup> Maurya, S. K., Kushwaha, A. K., & Seth, A. (2015). Ethnomedicinal review of Usnakantaka (*Echinops echinatus* Roxb.). *Pharmacognosy Reviews*, 9(18), 149–154. <https://doi.org/10.4103/0973-7847.162138>
- <sup>v</sup> Vaishya, S. (2011). *Shaligram Nighantu*. Khemraj Shrikrishnadas. (Guduchyadi Varga, Verses 45-46).
- <sup>vi</sup> Narahari, P. (2010). *Raja Nighantu* (I. Tripathi, Trans. & Ed.). Chaukhambha Krishnadas Academy. (Karviryadi Varga, Verses 112-114).
- <sup>vii</sup> Kaiyadeva. (2006). *Kaiyadeva Nighantu* (P. V. Sharma & G. Sharma, Trans. & Eds.). Chaukhambha Orientalia. (Oshadhi Varga, Verses 85-87).
- <sup>viii</sup> Ojha, J. K. (2004). *Dhanvantari Nighantu*. Chaukhambha Sanskrit Pratisthan. (Guduchyadi Varga, Verses 14-16).
- <sup>ix</sup> Vaidya, B. (2007). *Nighantu Adarsha* (Vol. II). Chaukhambha Bharati Academy. (Sahadevyadi Varga).
- <sup>x</sup> Government of India, Ministry of AYUSH. (2001). *The Ayurvedic Pharmacopoeia of India* (Part I,

Vol. I). Pharmacopoeia Commission for Indian Medicine & Homoeopathy.

<sup>xi</sup> Government of India, Ministry of AYUSH. (2004). *The Ayurvedic Pharmacopoeia of India* (Part I, Vol. IV). Pharmacopoeia Commission for Indian Medicine & Homoeopathy.

<sup>xii</sup> Yeole, K. R., Wadekar, R. R., & Patil, K. S. (2025). Exploring the Phytopharmacognostic Profile of *Tricholepis glaberrima* DC (Brahmadandi) Stem. *Journal of Natural Remedies*, 25(6), 1347–1354. <https://doi.org/10.18311/jnr/2025/47609>

<sup>xiii</sup> Eljounaidi, K., & Cankar, K. (2016). Cynaropicrin: A Comprehensive Review of Its Phytochemistry and Pharmacology. *Frontiers in Pharmacology*, 7, 472. <https://doi.org/10.3389/fphar.2016.00472>

<sup>xiv</sup> Bitew, H. H., & Hymete, A. A. (2019). The Genus *Echinops*: Phytochemistry and Biological Activities: A Review. *Frontiers in Pharmacology*, 10, 1234. <https://doi.org/10.3389/fphar.2019.01234>

<sup>xv</sup> Salam, P. M., Dandale, S., & More, D. B. (2023). A Review on Controversial herb Brahmadandi (*Tricholepis glaberrima*. DC). *International Journal of Emerging Technologies and Innovative Research*, 10(10), c758-c766.

<sup>xvi</sup> Agrawal, M., Nahata, A., & Dixit, V. K. (2012). Protective effects of *Echinops echinatus* on testosterone-induced prostatic hyperplasia in rats. *European Journal of Integrative Medicine*, 4(2), e177-e185. <https://doi.org/10.1016/j.eujim.2012.01.004>

<sup>xvii</sup> Chavan, K. R., Mohale, D. S., & Chandewar, A. V. (2024). Pharmacological Evaluation of *Tricholepis glaberrima* for Antidiabetic potential in animal model. *Research Journal of Pharmacology and Pharmacodynamics*, 16(4), 283-290. <https://doi.org/10.52711/2321-5836.2024.00049>

<sup>xviii</sup> Gound, S. S., Thakare, V. N., Khan, S., Wadekar, R. R., & Naik, S. R. (2015). Ameliorative effects of *Tricholepis glaberrima* in experimentally induced hepatic damage in rats: Modulation of cytokines functions. *Journal of Ethnopharmacology*, 160, 164-172. <https://doi.org/10.1016/j.jep.2014.11.037>

<sup>xix</sup> Singh, B., Gambhir, S. S., Pandey, V. B., & Joshi, V. K. (1989). Anti-inflammatory activity of *Echinops echinatus*. *Journal of Ethnopharmacology*, 25(2), 189-199. [https://doi.org/10.1016/0378-8741\(89\)90019-1](https://doi.org/10.1016/0378-8741(89)90019-1)

<sup>xx</sup> Priyadarshi, A., & Singh, S. (2018). Pharmacognostical and phytochemical analysis of Pippali (*Piper longum* Linn.) and comparative review with *Tricholepis glaberrima*. *Journal of Pharmacognosy and Phytochemistry*, 7(5), 289-293.