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The genus *Murdannia* (Commelinaceae): Diversity, medicinal potential, and future perspectives with emphasis on *Murdannia satheeshiana*

Madhumitha S[1], Vennila S[2], Saradha M[2*]
[1] Research Scholar, Department of Botany, Nirmala College for Women (Autonomous), Tamil Nadu, India
[2] Assistant Professor, Department of Botany, Nirmala College for Women (Autonomous), Tamil Nadu, India
Corresponding Author: Saradha M
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Abstract
The genus *Murdannia* Royle (Commelinaceae) comprises approximately 60 accepted species distributed throughout tropical and subtropical regions, with tropical Asia, particularly India, representing its principal centre of diversity. Several species have been traditionally used in indigenous medicine for the treatment of inflammatory disorders, skin diseases, respiratory ailments, diabetes, and cancer. In recent years, scientific investigations have demonstrated that selected *Murdannia* species possess diverse phytochemical constituents, including phenolics, flavonoids, alkaloids, glycosides, tannins, steroids, and other bioactive metabolites, which contribute to their reported antioxidant, antimicrobial, anti-inflammatory, analgesic, anticancer, antidiabetic, immunomodulatory, and antiproliferative activities. However, these investigations remain restricted to only a limited number of species, particularly *Murdannia loriformis*, *M. nudiflora*, *M. spirata*, and *M. bracteata*, whereas most members of the genus remain poorly explored. This review provides a comprehensive synthesis of the available literature on the taxonomy, diversity, geographic distribution, ecology, ethnobotanical importance, phytochemical composition, and biological activities of the genus *Murdannia*. Particular emphasis is placed on *Murdannia satheeshiana*, a narrowly endemic species of the southern Western Ghats of India, for which current knowledge is largely confined to taxonomic description and distribution. The absence of information on its phytochemistry, pharmacological properties, molecular characterization, tissue culture, and conservation biology highlights significant research gaps. Future multidisciplinary studies integrating phytochemical profiling, pharmacological validation, molecular approaches, biotechnology, and conservation strategies are essential to unlock the medicinal potential of this underexplored genus and to promote the sustainable utilization and conservation of endemic *Murdannia* species.

Keywords: *Murdannia*, Commelinaceae, taxonomic documentation, Southern Western Ghats, Walayar, biodiversity

Introduction
Medicinal plants represent an important source of traditional healthcare systems and modern therapeutic agents due to their diverse secondary metabolites possessing significant biological and pharmacological activities. Natural products derived from medicinal plants continue to contribute significantly to drug discovery and development, particularly through the investigation of underexplored plant species that may serve as potential sources of novel bioactive compounds (Farooqi *et al*., 2018). Although considerable progress has been achieved in medicinal plant research, scientific investigations are still largely focused on a limited number of commercially important species. In contrast, many endemic, rare, and traditionally less-utilized plants remain insufficiently explored in terms of their taxonomy, ecology, phytochemistry, pharmacology, conservation, and biotechnological applications (Patwari *et al*., 2014) [10]. The genus *Murdannia* Royle belongs to the family Commelinaceae under the order Commelinales and represents one of the diverse genera within the family. It comprises approximately 60 accepted herbaceous annual and perennial species distributed mainly across tropical and subtropical regions of Asia, Africa, Australia, and other parts of the world (Govaerts *et al*., 2012) [4]. Members of this genus generally occur in wetlands, marshes, grasslands, forest margins, paddy fields, and seasonally moist habitats. Species of *Murdannia* exhibit considerable morphological diversity, including succulent or non-succulent herbaceous habits, three-petaled flowers, trilocular capsules, and distinctive seed morphological characteristics, which contribute significantly to their taxonomic identification and classification (Sengthong *et al*., 2025) [13]. Beyond their taxonomic importance, several *Murdannia* species have gained scientific attention due to their ethnomedicinal applications and reported pharmacological properties. Previous studies have demonstrated various biological activities, including antioxidant, antimicrobial, anti-inflammatory, antidiabetic, and anticancer potential, which are mainly attributed to the presence of diverse secondary metabolites such as phenolics, flavonoids, glycosides, and other bioactive compounds. However, available phytochemical and pharmacological investigations are restricted to only a few species, while many members of the genus remain unexplored for their medicinal potential (Soraya *et al*., 2021). Among the underexplored members of the genus, *Murdannia satheeshiana* Joby *et al*. represents a recently described endemic species of the southern Western Ghats of India. The species was reported from Mathikettan Shola National Park, Kerala, and is distinguished from closely related taxa, particularly *Murdannia pauciflora*, based on its vegetative, floral, and seed morphological characteristics (Joby *et al*., 2011) [5]. Although its taxonomic identity and distribution have been documented, information regarding its phytochemical composition, biological activities, molecular characterization, propagation techniques, and conservation strategies is currently lacking.

Therefore, *M. satheeshiana* represents a potential candidate for future multidisciplinary investigations. The present review provides a comprehensive overview of the genus *Murdannia*, covering its taxonomy, species diversity, distribution, ecology, ethnobotanical importance, phytochemical profile, and reported biological activities. Furthermore, emphasis is placed on *M. satheeshiana* to highlight existing knowledge gaps and future research opportunities related to phytochemical exploration, pharmacological validation, molecular studies, tissue culture, and conservation approaches for this underexplored endemic species.

Taxonomy, Distribution, and Ecology of the Genus *Murdannia*

1. Taxonomic Position of the Genus *Murdannia*

The genus *Murdannia* Royle belongs to the family Commelinaceae under the order Commelinales and is one of the largest genera within the family. It was established by John Forbes Royle in 1840 based on *Aneilema scapiflorum* Roxb. (Currently recognized as *Murdannia edulis*), and the generic name honours Murdan Ali, the curator of the Saharanpur Botanic Garden herbarium, India. Species of the genus are annual or perennial herbs characterized by spirally arranged or distichous leaves, terminal or axillary thyrsoid inflorescences composed of cincinni, three free petals, three fertile stamens alternating with three staminodes, a trilocular ovary, capsular fruits, and distinctive seed morphology, which serve as important diagnostic characters for species identification and classification (Royle, 1840; Faden, 1998) [3].

Taxonomic classification of the genus *Murdannia*

Rank	Classification
Kingdom	Plantae
Phylum	Streptophyta
Class	Equisetopsida
Subclass	Magnoliidae (Angiosperms)
Order	Commelinales
Family	Commelinaceae
Genus	*Murdannia* Royle

The taxonomic placement of *Murdannia* within Commelinaceae provides the systematic framework for understanding its diversity, evolutionary relationships, and species delimitation.

2. Species Diversity, Distribution, and Ecology

Murdannia currently comprises approximately 60 accepted species distributed throughout tropical and subtropical regions of Asia, Africa, Australia, and the Americas. Tropical Asia represents the principal centre of species diversity, while India harbours one of the highest numbers of species, including several endemic taxa. Continued botanical exploration and taxonomic revisions have resulted in the description of additional species such as *M. striatipetala*, *M. fadeniana*, *M. brownii*, *M. sahyadrica*, and *M. satheeshiana*, highlighting the expanding taxonomic knowledge of the genus (Faden, 1998; Nampy & Joby, 2003) [3, 7].

Table 1: Diversity and current research status of selected *Murdannia* species

S. No.	Species	Geographic distribution	Endemic status	Current research status
1	*Murdannia loriformis*	Thailand, Malaysia, China, Vietnam	No	Extensively studied for phytochemistry and pharmacology.
2	*Murdannia nudiflora*	Tropical Asia, Africa, Australia	No	Moderately investigated for traditional uses and biological activities.
3	*Murdannia spirata*	India, Southeast Asia	No	Limited phytochemical and pharmacological studies.
4	*Murdannia semiteres*	Peninsular India	Yes	Limited scientific studies available.
5	*Murdannia gigantea*	India	Yes	Primarily documented taxonomically.
6	*Murdannia juncoides*	India, Sri Lanka	No	Mainly investigated for taxonomic purposes.
7	*Murdannia fadeniana*	Southern India	Yes	Known primarily from taxonomic reports.
8	*Murdannia striatipetala*	India, Sri Lanka	No	Poorly investigated scientifically.
9	*Murdannia brownii*	Western Ghats, India	Yes	Recently described with limited published data.
10	*Murdannia sahyadrica*	Western Ghats, India	Yes	Recently described; research remains limited.
11	*Murdannia satheeshiana*	Southern Western Ghats, India	Yes	Currently known only from taxonomic studies.

The genus *Murdannia* exhibits considerable diversity in terms of geographic distribution and research attention. While species such as *M. loriformis* and *M. nudiflora* have been investigated for their phytochemistry and pharmacological properties, many endemic taxa remain poorly studied. In particular, *M. satheeshiana* is currently known primarily from taxonomic descriptions, with no published information available on its phytochemistry, biological activities, molecular biology, or conservation strategies. These knowledge gaps emphasize the need for multidisciplinary investigations of underexplored *Murdannia* species (Nandikar & Gurav, 2015) [8]. The species of *Murdannia* occupy diverse ecological habitats, including wetlands, marshes, paddy fields, forest margins, rocky grasslands, lateritic plateaus, and seasonally moist environments. Many species are adapted to humid or periodically waterlogged conditions, whereas several endemic taxa are restricted to specialized habitats in the Western Ghats. This ecological diversity contributes to the remarkable morphological variation within the genus and emphasizes its ecological and conservation significance (Pellegrini *et al*., 2017) [11].

Ethnobotanical Importance of *Murdannia* Species

Ethnobotanical knowledge provides an important foundation for identifying medicinal plants with potential therapeutic value and has guided the discovery of numerous plant-derived drugs. Although the genus *Murdannia* comprises approximately 60 species, only a limited number have been documented in traditional medicinal systems. The reported ethnomedicinal uses are mainly associated with species distributed in South and Southeast Asia, where different plant parts are employed in the treatment of various human ailments.

These traditional applications provide valuable leads for phytochemical and pharmacological investigations.

Table 2: Reported ethnobotanical uses of selected *Murdannia* species

S. No.	Species	Traditional use	Plant part used	Method of preparation
1	*Murdannia loriformis*	Cancer, diabetes, bronchitis, hepatomegaly, constipation, and as a cooling agent	Whole plant, leaves	Fresh juice, decoction, and herbal preparations
2	*Murdannia bracteata*	Inflammation, liver disorders, kidney diseases, skin rashes, and cancer	Whole plant	Decoction and paste
3	*Murdannia spirata*	Skin disorders, including leprosy	Whole plant	Crushed paste applied externally
4	*Murdannia semiteres*	Respiratory disorders	Fruit, whole plant	Extract or decoction
5	*Murdannia brownii*	Skin irritation and localized swelling	Aerial parts	Poultice

The available ethnobotanical evidence indicates that medicinal uses have been reported for only a few *Murdannia* species (Table 2). Among them, *Murdannia loriformis* is the most extensively utilized and has traditionally been used for the management of cancer, diabetes, bronchitis, hepatomegaly, constipation, and as a cooling agent. *Murdannia bracteata* is commonly employed for inflammatory disorders, liver and kidney diseases, skin conditions, and cancer, whereas *M. spirata* and *M. semiteres* have comparatively limited ethnomedicinal applications, primarily for skin and respiratory disorders, respectively. Traditional use of *M. brownii* has also been reported for minor skin irritation and localized swelling. Overall, the ethnobotanical information available for the genus remains scarce and is restricted to a small proportion of species, highlighting the need for systematic documentation and scientific validation of traditional knowledge, particularly for poorly studied endemic taxa such as *Murdannia satheeshiana*.

Phytochemical Profile of *Murdannia* Species

Phytochemical investigations on the genus *Murdannia* remain limited and are currently available for only a few species. Nevertheless, published studies have demonstrated the presence of diverse classes of secondary metabolites, including phenolic compounds, flavonoids, tannins, alkaloids, Steroids, glycosides, pigments, and other bioactive constituents. These metabolites are considered responsible for many of the pharmacological properties reported for the genus and provide a scientific basis for its traditional medicinal applications (Soraya *et al*., 2021). Among the investigated species, *Murdannia loriformis* has received the greatest phytochemical attention. Qualitative and quantitative analyses have revealed the presence of phenolics, flavonoids, condensed tannins, alkaloids, steroids, chlorophyll pigments, membrane lipids, phytosterol glucosides, glycosphingolipids, syringic acid, isovitexin, phenylalanine, and steroidal glucosides, demonstrating the chemical diversity of the species (Soraya *et al*., 2021) [2]. GC–MS analysis has further identified compounds such as 2-furanone, 3,4-dihydroxytetrahydro-4H-pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl, and 1,2,3-propanetriol diacetate in *M. loriformis*, while *M. spirata* contains salicylaldehyde azine, diphenylfurazan N-oxide, benzoic acid derivatives, and anthracenedione derivatives (Mayur *et al*., 2018) [6]. In addition, phytochemical screening of *Murdannia nudiflora* has reported flavonoids, phenolic compounds, and other antioxidant constituents, whereas qualitative studies on *Murdannia* species have demonstrated the presence of flavonoids, phenolics, and glycosides but the absence of alkaloids, terpenoids, anthraquinones, and saponins in certain samples (Pellegrini *et al*., 2017) [11].

Table 3: Reported phytochemical constituents of selected *Murdannia* species

S. No.	Species	Major phytochemicals	Analytical technique	Biological significance
1	*Murdannia loriformis*	Phenolics, flavonoids, tannins, alkaloids, steroids, glycosphingolipids, isovitexin, syringic acid	Phytochemical screening, HPLC, GC–MS	Antioxidant, cytotoxic, anti-inflammatory
2	*Murdannia loriformis*	2-Furanone, 4H-pyran-4-one, glycerol derivatives	GC–MS	Antimicrobial, anti-inflammatory
3	*Murdannia spirata*	Salicylaldehyde azine, Diphenylfurazan N-oxide, benzoic acid derivatives	GC–MS	Fungicidal and antimicrobial potential
4	*Murdannia nudiflora*	Apigenin-7-O-glucoside, luteolin, ferulic acid*	HPLC/LC–MS	Antioxidant and anti-inflammatory*
5	*Murdannia* sp.	Flavonoids, phenolics, glycosides	Qualitative phytochemical screening	Antioxidant potential

The available phytochemical evidence indicates that comprehensive chemical investigations have been conducted for only a few *Murdannia* species, with *M. loriformis* being the most extensively studied. Most reports describe the occurrence of phenolic compounds, flavonoids, glycosides, steroids, and other bioactive metabolites that may contribute to the pharmacological properties of the genus. In contrast, phytochemical information for endemic species, including *Murdannia satheeshiana*, *M. brownii*, *M. sahyadrica*, and *M. fadeniana*, is currently unavailable. This lack of chemical characterization represents an important research gap and highlights the need for comprehensive phytochemical investigations to facilitate future pharmacological and drug discovery studies (Ancy *et al*.,2012) [1].

Pharmacological and Biological Activities of *Murdannia* Species

Pharmacological investigations of the genus *Murdannia* remain limited, although the available evidence indicates that several species possess promising therapeutic potential. The reported biological activities are primarily attributed to the presence of phenolics, flavonoids, alkaloids, tannins, glycosides, and other secondary metabolites, which are known to exhibit diverse pharmacological properties (Che Sulaiman *et al*., 2021) [2]. Among the investigated species,

Murdannia nudiflora has demonstrated significant analgesic activity in the hot plate model using albino mice. Phytochemical screening of the ethanolic leaf extract revealed the presence of flavonoids, tannins, alkaloids, and saponins, suggesting that these constituents may contribute to the observed analgesic and anti-inflammatory effects (Patwari *et al*., 2014) [10]. Similarly, GC–MS analysis of *Murdannia loriformis* and *M. spirata* identified several bioactive compounds with potential pharmacological importance. The major constituents detected in *M. loriformis* include 2-furanone, 3, 4-dihydroxytetrahydro-4H-pyran-4-one, 2, 3-dihydro-3, 5-dihydroxy-6-methyl, and glycerol derivatives, whereas *M. spirata* was characterized by salicylaldehyde azine, diphenylfurazan N-oxide, benzoic acid derivatives, and anthracenedione derivatives. These compounds have been associated with antimicrobial, anti-inflammatory, fungicidal, and antiproliferative activities, indicating the medicinal potential of these species (Mayur *et al*., 2018) [6]. Among all members of the genus, *Murdannia loriformis* is the most comprehensively studied. Previous investigations have demonstrated a broad spectrum of pharmacological activities, including antioxidant, antimicrobial, anti-inflammatory, anticancer, antimutagenic, and immunomodulatory effects. These biological properties are largely attributed to its abundance of phenolic compounds, flavonoids, glycosphingolipids, and other bioactive metabolites (Che Sulaiman *et al*., 2021) [2]. In addition, an aquatic *Murdannia* species has been reported to possess antibacterial activity against the fish pathogen *Edwardsiella ictaluri*. Phytochemical analysis confirmed the presence of flavonoids, phenolic compounds, glycosides, and antioxidant constituents, while antibacterial assays demonstrated moderate inhibitory activity, suggesting its potential application as a natural therapeutic agent in aquaculture (Nugraha *et al*., 2020) [9].Overall, the available literature indicates that *Murdannia* species exhibit diverse biological activities, including analgesic, antioxidant, antimicrobial, anti-inflammatory, anticancer, antimutagenic, immunomodulatory, antiproliferative, and fungicidal effects. However, these investigations have been confined to only a small proportion of the genus, whereas most species, including the endemic *Murdannia satheeshiana*, remain unexplored. Comprehensive pharmacological studies integrating phytochemical characterization, mechanistic investigations, and preclinical validation are therefore required to establish the therapeutic potential of these underexplored taxa.

Research Gaps and Future Perspectives with Emphasis on *Murdannia satheeshiana*

1. Lack of Phytochemical Studies

Murdannia satheeshiana is a recently described endemic species of the Western Ghats, and no published studies have investigated its phytochemical composition. Unlike *M. loriformis* and a few other species, its secondary metabolites remain unknown. Comprehensive phytochemical profiling using modern analytical techniques such as GC–MS, LC–MS, HPLC, and NMR is therefore needed to identify bioactive constituents and assess its medicinal potential.

2. Lack of Pharmacological Validation

No experimental studies have evaluated the biological activities of *M. satheeshiana*. While several *Murdannia* species exhibit antioxidant, antimicrobial, anti-inflammatory, and anticancer properties, similar investigations are lacking for this species. Future *in vitro* and *in vivo* studies are required to validate its pharmacological potential and safety.

3. Limited Molecular Research

Current information on *M. satheeshiana* is largely restricted to its taxonomic description. Molecular studies, including DNA barcoding and phylogenetic analyses, are lacking. Such approaches would improve species identification, clarify evolutionary relationships, and support future taxonomic and conservation studies.

4. Need for Tissue Culture and Conservation

As a narrow endemic species, *M. satheeshiana* may be vulnerable to habitat disturbance. However, no reports are available on its micropropagation, *in vitro* conservation, or germplasm preservation. Developing tissue culture protocols and conservation strategies will be important for its sustainable utilization and long-term protection.

5. Future Perspectives

Future research should focus on the integrated investigation of *M. satheeshiana*, including phytochemical characterization, pharmacological evaluation, molecular studies, tissue culture, and conservation biology. Such multidisciplinary studies will improve our understanding of this endemic species and may reveal its potential as a valuable medicinal and conservation resource.

Conclusion

The genus *Murdannia* represents a diverse and underexplored group within the family Commelinaceae, exhibiting considerable taxonomic, ecological, and medicinal significance. Although several species have been traditionally used for the treatment of various ailments and have demonstrated promising phytochemical and pharmacological properties, scientific investigations remain restricted to only a few taxa. Existing studies on species such as *Murdannia loriformis*, *M. bracteata*, and *M. spirata* have revealed the presence of diverse bioactive constituents and biological activities, supporting the medicinal potential of the genus. However, many endemic and recently described species remain poorly investigated, particularly *Murdannia satheeshiana*, which is currently known mainly from taxonomic and distributional studies. The absence of information regarding its phytochemical composition, pharmacological properties, molecular characterization, and propagation methods represents significant research gaps. Future multidisciplinary investigations integrating phytochemistry, pharmacology, molecular approaches, tissue culture, and conservation biology are essential to understand the full potential of this species. Comprehensive investigations on *Murdannia satheeshiana* may reveal novel bioactive compounds and provide valuable insights into the medicinal potential and conservation requirements of this endemic species.

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