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Review on *Tradescantia spathacea* (Medicinal Plant)

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ABSTRACT

Tradescantia spathacea, often known as Moses-in-the-Cradle, is a perennial herbaceous plant of the Commelinaceae family. This species is native to Central America and the Caribbean, and it has grown in favour as an ornamental plant due to its vivid leaf and low maintenance requirements. Aside from its visual attractiveness, T. spathacea has received interest for its medicinal effects and environmental adaptation. This review brings together current studies on its phytochemistry, therapeutic potential, and environmental significance. Key phytochemical ingredients, including flavonoids, saponins, and phenolic compounds, are highlighted for their antioxidant, antibacterial, and anti-inflammatory properties. The plant's involvement in environmental clean-up, notably heavy metal pollution reduction, is also mentioned. Despite its adaptability, issues such as invasiveness and habitat-specific growth requirements necessitate additional investigation. This review is to provide a thorough overview of Tradescantia spathacea, linking its decorative, medicinal, and ecological roles while recommending opportunities for future research and use. T. spathacea is extremely resilient to stress situations, such as poor soils and urban pollution, making it an important component in green infrastructure and phytoremediation programs. Its ability to gather heavy metals and enhance soil quality has been investigated as a possible tool for environmental management. However, its quick spread and adaptability have created worries about its invasive tendencies in some areas, necessitating a cautious approach to cultivation and use.

Keywords- Tradescantia spathacea, Moses-in-the-cradle, ornamental plant, Phytochemistry.

I. INTRODUCTION

The Commelinaceae family includes 37 genera and 600 species of monocotyledonous herbaceous flowering plants, including spiderworts (Tradescantia sp.). Originally from the old-world tropics, these species are now found in both hemispheres' subtropics and tropics, with some even surviving in temperate climes. These plants are often grown for ornamental purposes due to their bluish or purplish leaves and/or flowers. However, they are also used ethnobotanically to treat diseases such as mycosis, venereal disease, wounds, gastrointestinal disorders, and cancer due to their antibacterial and antioxidant properties. Few studies have examined the antibacterial and antioxidant effects of these plants[1]. The plant has spread to tropical and subtropical climates, where it has grown entrenched and invasive, especially in Florida. This succulent plant has a dense clump of long, lance-shaped leaves (15-30 cm) that grow from the trunk. can grow up to 20 cm. The leaves have two colours: green above and purple below. The leaves are the plant's major ornamental element. Flowers and seeds are produced throughout the year. This species' blooms are used to alleviate dysentery in China and for cosmetic purposes in Yucatan, Guatemala, and Belize[2] Commelinaceae plants are abundant in renewable bioactive chemicals due to their evergreen, perennial, and hardy nature. Commelinaceae, like other silicon-accumulating plant families including Gramineae (rice/wheat) and Cucurbitales (pumpkin/squash), are less prone to growth, development, and reproductive problems compared to plants with less efficient silicon accumulation. Many Commelinaceae species are considered weeds and pests because to their quick growth, resilience, and rooting at nodes. They are

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resistant to most herbicides and can recover quickly if left untreated. These characteristics make them a sustainable and abundant source of bioactive chemicals[3]. Our group earlier reported on the antioxidant and antibacterial properties of Rhoeo spathacea (Swartz) Stearn leaves. This research reports on the bioactivity of two additional R. spathacea cultivars, which have not been previously examined. Rhoeo bermudensis is a dwarf cultivar of R. spathacea, sometimes known as Tradescantia spathacea "Hawaiian Dwarf" or Rhoeo spathacea nana[4].The plant has comparable physical characteristics to R. spathacea (Swartz) Stearn, but with smaller leaves (10-20 cm vs. 15-30 cm). The plant grows to 30-45 cm tall, which is roughly 60% the height of R. spathacea (Swartz) Stearn. Unlike R. spathacea, this plant does not have blooms but can quickly root at nodes and spread throughout the ground, similar to other Commelinaceae species. Also known as the Hawaiian dwarf or dwarf oyster plant. Rhoeo spathacea var. variegata, commonly known as Rhoeo spathacea vittata, resembles R. spathacea (Swartz) Stearn but has yellow striations on the upper side of the leaves, unlike the original cultivar's harsh green upper side [5].

Fig.1 Plant Tradescantia Spathacea

II. TAXONOMICAL CLASSIFICATION

Table No 1:

Kingdom	Plantae
Phylum	Spermatophyta
Subphylum	Angiospermae
Class	Monoctyedonae
Order	Commelinales
Family	Commelonaceae
Genus	Tradescantia
Species	Tradescantiaspathacea

Morphological Characteristics of Tradescantia spathacea

Macroscopic evaluation - The macroscopic evaluation of Tradescantia spathacea focuses on the observable physical characteristics of the plant, which are vital for its identification and ornamental significance.[6]

Table No 2:

Leaf	Alternate, Overpopulated, enlarge (Fig-2)
Shape	Pointed, elongated, sword-shaped
Size	Length and width 30-40cm and 4-6cm
Texture	Rough and stiff
Apex	Narrowed or pointed end
Colour	Dark green on the upper surface and rosy purple on the leaf lower side
Taste	Bitter
Margin	Entire
Surface	Both surfaces are smooth
Odour	Characteristics

Fig.2 Plant of tradescantia spathacea

1. General Appearance

- A compact, rosette-forming herbaceous perennial with dense foliage and a neat, layered structure.
- Height ranges from 20–40 cm, with a spread that can extend to 30–50 cm depending on growing conditions. [7]

2. Leaves [Fig.3]

- Shape: Lanceolate to sword-shaped, tapering to a pointed tip.
- Size: 15–30 cm long and 3–5 cm wide.
- Colour:
  - Upper surface: Smooth, glossy dark green.
  - Underside: Distinctive purple or violet hue.
- Texture: Slightly fleshy, with a waxy coating.
- Arrangement: Alternately arranged in a spiral pattern around the stem, forming a basal rosette.
- Margin: Entire and smooth. [7-8]

Fig.3- tradescantia spathacea leaves and stems

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3. Stems[Fig.3]

- Type: Short, thick, and fleshy.
- Colour: Green or light purple, often partially covered by overlapping leaf bases.
- Function: Provides structural support and stores nutrients [8-9].

4. Flowers [Fig.4]

- Size: Small, typically 1–2 cm in diameter.
- Colour: White petals.
- Structure: Enclosed within purple, boat-shaped bracts (spathes).
- Position: Arise from the leaf axils, nestled within the spathes.
- Flowering Period: Occurs intermittently throughout the year under favourable conditions [9]

Fig.4- tradescantia spathacea flower

Fig.5-tradescantia spathacea roots

5. Roots [Fig.5]

- Type: Fibrous and shallow.
- Function: Efficient at nutrient uptake in well-draining soils.
- Adaptability: Supports propagation through division or cuttings [10].

6. Fruits and Seeds

- Fruit Type: Small, capsule-like structures.
- Seeds: Rarely formed, as the plant reproduces more commonly through vegetative means.[11]

7. Texture and Growth

- Overall texture is smooth and fleshy, with a slight rigidity in the leaves and stems.
- Growth habit is spreading, with a tendency to form dense mats in the absence of pruning or division.[12]

Organoleptic properties –

Organoleptic properties refer to the sensory characteristics of a substance that can be perceived by the human senses, including sight, taste, touch, smell, and hearing. In the case of *Tradescantia spathacea* (Moses-in-the-cradle or boat lily), the organoleptic properties are not typically a focus of study for this plant as it is primarily ornamental rather than used for consumption or direct sensory evaluation. However, here are some potential organoleptic properties of *Tradescantia spathacea*:[13]

1. Sight (Visual Appearance):

- Leaves: The plant has attractive, variegated leaves, which are usually purple on the underside and green on the upper surface. This contrasting colour pattern makes it visually striking and a popular choice for ornamental gardening.
- Flowers: The flowers are small and showy, with purple and white petals, which can be visually appealing in the plant's overall display.
- Shape: The plant has a rosette-like growth habit, with elongated, lance-shaped leaves arranged in a symmetrical pattern [14].

2. Taste (Flavour):

- *Tradescantia spathacea* is not commonly consumed, and there is little documented information on its taste properties.
- As an ornamental plant, it is not generally considered for culinary uses, and tasting parts of the plant may not be recommended due to a lack of information about its edibility or safety for consumption [15].

3. Touch (Texture):

- Leaves: The leaves are smooth and somewhat waxy, with a firm texture. The upper surface can feel slightly leathery, while the underside may have a soft, velvety texture due to fine hairs or trichomes.
- Stems: The stems are soft and flexible, though the plant's overall feel can vary depending on growth conditions and maturity [16].

4. Smell (Aroma):

- *Tradescantia spathacea* does not have a strong or distinctive fragrance. The leaves and flowers may release a mild, neutral scent when crushed, but it is not known for any notable aromatic properties [17].

5. Hearing (Sound):

- *Tradescantia spathacea* does not produce any particular sound, as it is a non-auditory organism [18].

III. PHYTOCHEMICAL CONSITUENTS

Qualitative phytochemical screening of T. spathacea leaf extracts has been intensively studied by

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several researchers and revealed a variety of bioactive compounds. Through careful phytochemical testing, these studies confirmed the presence of alkaloids, glycosides, carbohydrates, tannins, flavonoids, anthocyanins, coumarins and saponins in chloroform and methanolic leaf extracts. Another study also found phytosterols, phenolics, tannins and terpenoids in methanolic leaf extracts [19]. However, it is important to note that these studies did not isolate and identify these secondary metabolites [20].

Quantitative phytochemical screening assays, including total phenolic content (TPC) and total flavonoid content (TFC) measurements, have also reported in several studies, further confirmed that T. spathacea leaf extracts contain a significant number of phenolic compounds and flavonoids. One of the studies showed that the methanolic leaf extract demonstrated with a TPC of 203.9 ± 16.3 mg gallic acid equivalent (GAE) per 100 g of extract, and a TFC of 10.8 ± 2.9 mg rutin equivalent (RE) per 100 g of extract [21]. These results support the studies on the isolation of phytochemicals from T. spathacea leaf extracts, in which many phenolic compounds have been isolated [22].

Table No 3: Total phenolic content (TPC), total tannin content (TTC) and total flavonoid content (TFC) of T. spathacea [23].

	TPC (mg GAE/100 g sample)	TTC (mg TAE/100 g sample)	TFC (mg RE/100 g sample)
T. spathacea	203.9 ± 16.3	20.6 ± 2.3	10.8 ± 2.9

Through a combination of spectroscopic and chemical analyses, a total of 37 compounds were isolated from T. spathacea in six distinct studies [23]. These compounds, encompassing glycosides, quinones, phenolic compounds and flavonoids, predominantly belonged to polyphenols Notably, rhoeonin emerged as the most frequently isolated compound from T. spathacea leave, playing a pivotal role in imparting the red and purple hues to the leaves of T. spathacea. Among these reports, employed nuclear magnetic resonance (NMR) data to elucidate the structures of the isolated compounds. However, the resulting compounds were only analysed by HPLC PDA-MS/MS analysis without isolating or elucidating the structures of the compounds [24].

Table No. 4: Reported secondary metabolites of T. spathacea [25-29].

Class of compound	Isolated compounds	Appearance	Known biological activities
Flavanol	Kaempferol 1	Yellow powder	Protein Tyrosine Phosphatase 1B (PTP1B) inhibitory, IC50: 45.85 ± 0.59 µM
	Myricetin 2	Light yellow crystal	
	Quercetin 3	Yellow crystalline powder	
	Epigallocatechin 4	Yellow crystalline powder	
	Peltatoside 5	-	
	Rutin6	Solid	
	Kaempferol-O-hexosyl-pentoside 7	-	
	Quercetin dihexoside 8	Yellow crystalline powder	
	Isorhamnetin-O glucuronide 9	Yellow powder	
	Quercetin-O-hexoside 10	-	
	Isorhamnetin-O-hexoside 11	-	
Anthocyanine	Rhoeonin 12	-	
Phenols	Bracteanolide A 13	White amorphous powder	Compounds 13 to 23 exerted Protein Tyrosine Phosphatase 1B (PTP1B) inhibitory activities,
	4-(3′,4′ Dihydroxyphenyl) furan 2(5H)-one 14	Amorphous powder	IC50 values ranging 4.6-68.2 µM. The highest inhibitory activity is by compound 19 (IC

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	(S)-2-Hydroxy-3-(4′ hydroxyphenyl) propanoic acid 15	White needle	= 4.6 ± 0.9 µM).
	(R)-2-Hydroxy-3-(4′ hydroxyphenyl) propanoic acid 16	White amorphous powder	
	Latifolicinin C 17	Light yellow powder	
	Latifolicinin B 18	Syrup	
	Latifolicinin A 19	Syrup	
	1-(3′,4′-Dihydroxyphenyl) 2-hydroxyethan-1-one 20	Amorphous powder	
	Hydroxytyrosol 21	Syrup	
	Oresbiusin A 22	Syrup	
	(±)-Tradescantin 23	Amorphous powder	
	Syringyl-O-rhamnoside 24	-	
Phenolic acids	Ferulic acids 25	Amber coloured solid	
	Vanillic acid 26	White powder	
	Glycosylated vanillic acid 27	-	
	-coumaric acid 28	White solid	
	Chlorogenic acid 29	White solid	
	Protocatechuic acid 30	Light brown solid	

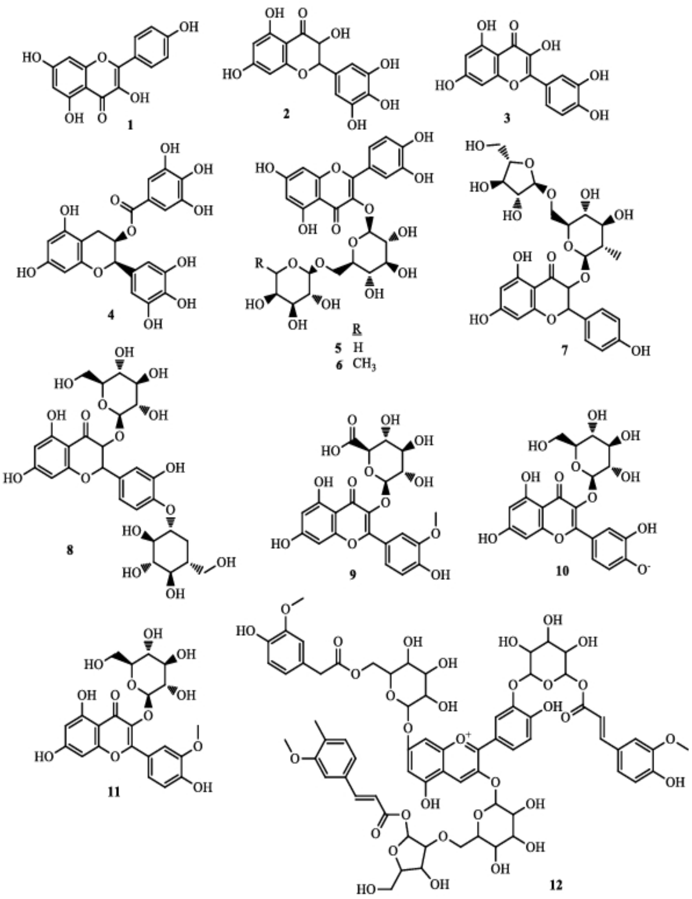

Fig.2 Flavonoids isolated from T. spathacea

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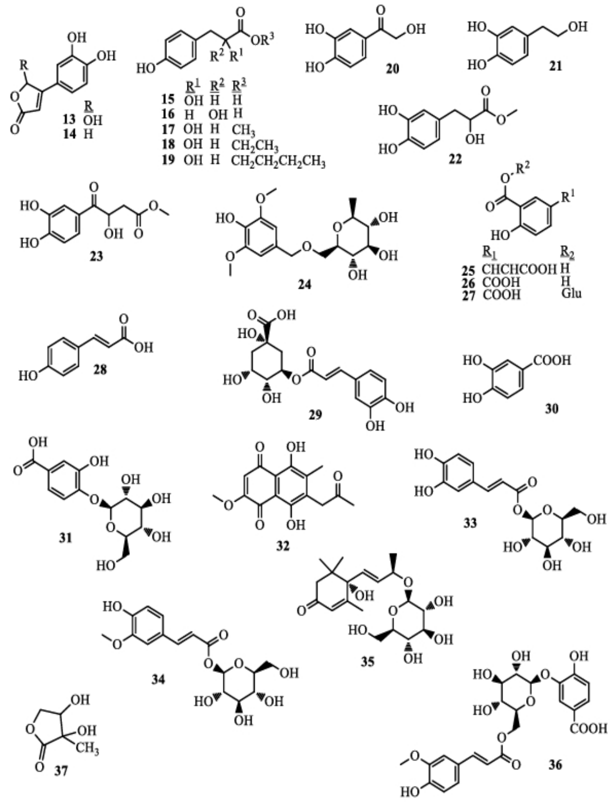

Fig 3. Phenolics and other compounds isolated from T. spathace

IV. PHARMACOLOGICAL ACTIVITIES

The phytochemical composition of Tradescantia species may explain their diverse bioactive capabilities. Epigallocatechin has been shown in studies to have bioactive qualities, including antioxidant, antidiabetic, anti-inflammatory, and antitumor effects. Hydroxytyrosol is a phytochemical molecule with antioxidant, anti-inflammatory, cancer-fighting, antidiabetic, and cardioprotective effects [30]. Tradescantia plants contain bioactive compounds such as rutin, epigallocatechin, (6S,9R) roseoside, kaempferol, oresbiusin A, hydroxytyrosol, protocatechuic acid, latifolicin (A, B, and C), and ferulic, vanillic, chlorogenic, and p-coumaric acids. Plant-derived antioxidants such as kaempferol, protocatechuic acid, rutin, and epigallocatechin have been linked to anticancer activity [31]. While individual components may have established bioactive characteristics, it's important to examine the combined bioactive potential of Tradescantia extracts due to potential synergistic effects. Only a few research have assessed the bioactivity of Tradescantia extracts [32].

1. *Antioxidant Activity*

Vegetable and dietary antioxidants are crucial for combating oxidative stress. Oxidative stress occurs when the formation of reactive oxygen species (ROS) in tissues and cells exceeds the body's ability to repair the damage with antioxidants [33]. This imbalance can lead to harmful effects by producing peroxides and free radicals. This causes damage to all cell components, including proteins, lipids, and DNA. Aerobic organisms use physiological and antioxidant defense mechanisms to prevent or slow excessive oxidation at the cellular level, and sometimes reverse oxidative damage to molecules [34]. The antioxidant system includes endogenous and exogenous antioxidants. Endogenous antioxidants include enzymes such as glutathione peroxidase, catalase, and superoxide dismutase, as well as non-enzymatic substances including glutathione, bilirubin, and uric acid. Dietary sources of exogenous antioxidants include vitamins (A, C, E), carotenoids (lutein, zeaxanthin, and lycopene), phenolic compounds (flavonoids, phenolic acids), glucosinolates, and organosulfur compounds [35]. Numerous studies have examined the antioxidant, anticancer, and anti-inflammatory potential of natural compounds like phenolic compounds and carotenoids using in vitro cell lines and animal models [36].

2. *Antimicrobial Activity*

T. spathacea leaf extracts (10, 30, 50 mg/mL) were tested against S. aureus, B. subtilis, and Escherichia coli, with cephalexin as a positive control. The study found that S. aureus and E. coli had the highest zones of inhibition (7.3 and 6.2 mm, respectively), but B. subtilis was resistant to the extracts [37]. The zone of inhibition was much lower than the positive standard tested at 1 mg/mL, with an average of 12.5 mm for S. aureus and 14.4 mm for E. coli.

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However, the bacterial strains and materials used in both investigations were not disclosed, raising issues regarding data repeatability. The study did not determine the MIC values, which are critical for determining the extracts' overall potency [38].

3. Anti-fungal activity

T. spathacea extracts were tested for antifungal activity against Candida albicans, C. parapsilosis, C. krusei, Cryptococcus neoformans, Aspergillus fumigatus, and Trichophyton interdigitale using a colorimetric broth microdilution method. Concentrations ranged from 0.02 to 2.5 mg/Ml [39]. The hexane and chloroform extracts had the lowest MIC values against C. neoformans (0.08 mg/mL). Other extracts had MIC values ranging from 0.16 to 0.63 mg/mL. However, antifungal efficacy against A. fumigatus could not be identified (MIC values > 2.5 mg/mL). The lack of material attribution poses a substantial difficulty to data repeatability. Another antimicrobial research is also listed in Table 2. Strong antibacterial action observed T. spathacea's traditional usage for treating infections, ulcers, and wounds is supported by scientific evidence [40].

4. Antiviral Activity

T. spathacea leaves have been shown to have antiviral characteristics and have been used to treat fever. They were also tested for their ability to combat the fatal Chikungunya virus, which is transmitted by mosquitos [41]. The study found that ethanolic and methanolic extracts at 512 µg/mL had a strong cytotoxic effect on Chikungunya virus in Vero cells, with inhibition rates of 92.6% and 91.5%, respectively. Additionally, an 80 µg/mL chloroform extract showed 88.8% inhibition. Quantitative RT-PCR analysis of viral load indicated that the 80 µg/mL of chloroform extract effectively reduced virus RNA replication by 83.7%, while the ethanol and methanol extracts reduced it by 52.7% and 46.3%, respectively [42].

5. Antitumoral and Anticancer Activity

The anticancer effects of aqueous T. spathacea leaf extract (0.0025 to 20 mg/kg p.o.) were examined in Fischer rats utilizing the resistant-hepatocyte model and the γ--glutamyl transpeptidase preneoplastic enzyme marker. The leaf extract at a concentration of 5 mg/kg p.o. showed the strongest protective effects against carcinogenic therapy, with a 70% survival rate [43]. Even at a high dose of 20 mg/kg p.o., the extract was not hazardous to rats. Combining N-diethylnitrosamine with the carcinogen 2 acetylaminofluorene resulted in toxicity and a 20% reduction in survival rates [44]. Further research is needed to determine the active components responsible for the leaf extract's antitumoral effect, as the mechanism of action remains unclear. aqueous T. spathacea leaf extract ranging from 1 ng/mL to 100 µg/mL was tested on human lymphocytes mononuclear cells with phytohemagglutinin (10 µg/mL) as the positive standard. Despite weak in vitro proliferative responses of human lymphocytes at the highest concentration (stimulation index, S. I., of 1.16), the aqueous extract was significantly less effective compared to the positive control with an S.I. of 335.80. Furthermore, the source of the materials used was not mentioned, raising concerns about data reproducibility [45].

6. Anti-inflammatory Activity

Inflammation is the immunological response of living organisms to infectious agents like viruses or bacteria. Common indications of inflammation include redness, discomfort, and fever. While synthetic medications can effectively treat inflammation, they can also cause negative effects. Plants having anti-inflammatory properties, such as Tradescantia species, have been examined as potential remedies for inflammatory conditions [46].

T. fluminensis, or Wandering Jew, has been found to have anti-inflammatory properties. T. albiflora substances, including bracteanolide A, methyl 3,4-dihydroxybenzoate, and hydroxytyrosol, have been shown to inhibit nitric oxide (NO) generation in a RAW 264.7 cell culture, indicating anti-inflammatory properties. NO generation during inflammation is an accurate predictor of the severity of the condition. 5-O-n-butyl bracteanolide A outperformed the other two compounds in terms of anti-inflammatory activity [47].

7. Cytotoxic Activity

The cytotoxicity of six medicinal plants, including T. zebrina, using neutral red uptake (NRU) and 3-(4,5 dimethylthiazol-2-yl)-2,5 diphenyltetrazolium bromide (MTT) assays. In this study, six extracts obtained with different solvents (chloroform, ethanol, methanol, water, ethyl acetate and hexane) were evaluated [48]. The cytotoxicity activity was evaluated in a monkey kidney epithelial cell (Vero) model using extract concentrations ranging from 5 to 640 µg/mL. The results showed that the chloroform, hexane and ethyl acetate ex tracts exhibited a higher level of toxicity to Vero cells than the aqueous, methanolic and ethanolic extracts. Therefore, the results indicated that the evaluated medicinal plants, in cluding T. zebrina, showed cytotoxicity depending on the concentration and the extraction solvent. It was also de tected that the NRU assay showed a higher level of reliability and sensitivity compared to the MTT assay to evaluate the cell viability of plant extracts [49].

8. Anti-diabetic and Anti-hyperglycaemic Activity

T. spathacea leaf extracts were tested in vitro for α-glucosidase inhibitory activity at concentrations ranging from 20 to 100 µg/mL. Acarbose was used as a positive control (20 to 100 µg/mL). The extract has an IC50 of 85 µg/mL, which was slightly higher than acarbose (IC50 = 51 µg/mL). [50]. The authors tested the methanolic extract of T. spathacea leaves for its anti-hyperglycaemic effects in vivo. Female rats were injected with alloxan monohydrate in a saline solution to develop type 2 diabetes. Rats were given 150, 200, and 400 mg/kg extract in 1% NaCMC. Positive control rats

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were fed alloxan, whereas negative control rats received 2 mL/kg of NaCMC. Blood glucose levels were monitored for seven days. T. spathacea dosages significantly lowered blood glucose levels from 200 mg/dl on the first day to less than 100 mg/dl on the seventh day. However, the reason for selecting high doses (above 200 mg/kg) was not explained. To conduct a meaningful pharmacological investigation, extracts should be administered at a maximum dose of 200 mg/kg in vivo. Additionally, no further research was conducted to identify the active components in the extract [51].

9. Hepatoprotective Activity

T. spathacea leaf ethanolic extract shown in vivo hepatoprotective efficacy against CCl4-induced liver fibrosis at two dose levels (100 mg/kg and 200 mg/kg). The study found that at 100 mg/kg, the extract reduced levels of AST, ALT, and ALP compared to a positive control of 25 mg/kg Silymarin. The results indicated that the ethanol extract (100 mg/kg) was comparable to the positive control. Further research is needed to find the most effective components and ideal levels for potential effects. Additional clinical investigations are strongly encouraged [52].

10. Other activities

Table 2 shows that several activities have been described, such as anti-genotoxic activity, vasorelaxant activity, blood anti-coagulant, and in vitro anti-helminthic [53]. García-Varela et al. studied the antigenotoxic effects of T. spathacea ethanolic leaf extract (1.9 to 500 ng) on hepatocyte cells treated with 1.25 μM diethylnitrosamine (DEN). The ethanolic extract of T. spathacea was non-genotoxic and effectively reversed 75% of the genotoxicity caused by DEN, indicating its promise as a chemoprotective agent [54].

The several activities have been described, such as anti-genotoxic activity, vasorelaxant activity, blood anti-coagulant, and in vitro anti-helminthic. García-Varela et al. studied the antigenotoxic effects of T. spathacea ethanolic leaf extract (1.9 to 500 ng) on hepatocyte cells treated with 1.25 μM diethylnitrosamine (DEN). The ethanolic extract of T. spathacea was non-genotoxic and effectively reversed 75% of the genotoxicity caused by DEN, indicating its promise as a chemoprotective agent [55].

The ethanolic extract of T. spathacea leaves at 10 and 20 mg/mL was tested against an adult Indian earthworm, Phreesia posthuma. The positive and negative controls were Albendazole (10 mg/mL) and 1% (m/v) Tween 80. The ethanolic leaf extract at 20 mg/mL and 10 mg/mL killed Pheretima posthuma in 120 and 150 minutes, respectively, while Albendazole killed it in 70 minutes. The absence of replication in the analysis raises doubts regarding the dependability of the results. To confirm the validity of an observation, analyse at least three separate replicates. Furthermore, the data's reproducibility is questioned due to the lack of defined source materials [56].

V. TRADITIONAL USES OF TRADESCANTIA SPATHACEA

Herbs have long been utilized for their scent, flavour, and therapeutic benefits. Herbs, whether fresh or dried, can be taken as tablets, capsules, powders, teas, or extracts. Tradescantia species are known for their anti-inflammatory, antioxidant, antibacterial, and antiarrhythmic effects. Roots have been used as a drink to treat kidney problems and digestive issues. Leaves have been used to treat stings and bug attacks. Table 2 summarizes the traditional usage of Tradescantia around the world. Traditional medicines should be read with caution because to the potential of this botanical source. Scientific proof is required to demonstrate the cause-and-effect link between these qualities [57].

T. spathacea is commonly used in traditional Chinese medicine to treat kidney disorders. This plant has traditionally been used in Jamaica to treat high blood pressure, cough, and tuberculosis. The leaves are thought to have therapeutic effects for reducing inflammation and treating haemorrhoids and kidney infections. In Mexico, a decoction of the leaves is commonly drunk as a cool drink called 'Matali'. Leaf extracts are used in the Caribbean to treat kidney and bladder disorders, as well as to alleviate intestinal irritation. Historically, Filipinos utilized the leaves as tea to cleanse their blood and alleviate influenza symptoms. Malaysians believe that a decoction of the plant can enhance kidney function and treat poisonous snake bites, leucorrhoea, urinary tract infections, nephritis, and bowel inflammation.[58]

T. spathacea, also known as Rhoeo spathacea or Rhoeo disccolor, has traditionally been used in China to cure diarrhoea and haemoptysis by a decoction of dried or fresh leaves and blossoms. In Singapore, this plant is traditionally used to cure fever, cough, and bronchitis. Despite its beneficial characteristics, ingesting the sap can cause skin and eye itching, as well as gastrointestinal and mouth pain [59].

Traditional applications may indicate the availability of bioactive chemicals that can prevent or treat specific ailments. Appropriate scientific procedures must be used to address the lack of evidence required to support such applications. Recent investigations suggest that traditional uses can be adapted for modern medicine [60].

VI. ECOLOGICAL AND ENVIRONMENTAL SIGNIFICANCE

1. Ecological Significance

- **Habitat and Biodiversity Support:** In its natural habitat, Tradescantia spathacea offers

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habitat and cover for small species such as insects, lizards, and invertebrates, which contributes to local biodiversity.

- **Pollinator Attraction:** The plant produces small flowers that attract pollinators like bees and butterflies, which help pollinate and support local ecosystems [61].

2. Environmental significance

- **Erosion Control:** Tradescantia spathacea, with its dense growth habit, can aid to stabilize soil, particularly in erosion-prone locations. This makes it valuable in landscaping for preventing erosion.
- **Air Purification:** Tradescantia spathacea, like many other plants, improves air quality by collecting CO2 and releasing oxygen. According to certain research, it may also be capable of filtering specific indoor air contaminants.
- **Aesthetic and Psychological Benefits:** Its decorative appeal improves urban and residential green spaces, while also giving psychological and physical benefits such as stress reduction and improved air quality in developed situations [62].

VII. CONCLUSION

Tradescantia spathacea, often known as the Moses-in-the-Cradle or Boat Lily, is a versatile and resilient plant with important applications in horticulture, pharmacology, and environmental research. This species, which is native to Central America's tropical regions, has successfully adapted to a variety of temperatures, making it a popular ornamental plant around the world. Its beautiful multicolor leaves and robust growth habit add to its aesthetic appeal, while its ability to flourish in low-maintenance environments increases its economic and ecological significance.

T. spathacea has gained scientific attention for its bioactive chemicals and potential therapeutic applications, in addition to its decorative value. Recent research has highlighted its antioxidant, antibacterial, and anti-inflammatory characteristics, emphasizing its potential for use in both traditional medicine and modern pharmacology. These findings imply that additional investigation into its phytochemical elements may reveal novel bioactive substances helpful to human health. Furthermore, its shown ability to tolerate contaminants makes it a good candidate for phytoremediation, increasing its ecological relevance in addressing environmental concerns.

Despite its multiple benefits, T. spathacea does not come without obstacles. Its status as an invasive species in some areas, owing to its aggressive growth and ability to outcompete local flora, necessitates careful control and research. This dichotomy emphasizes the necessity for a balanced approach to its use, ensuring that its benefits do not outweigh its environmental impact.

Future study should prioritize maximizing the plant's potential while resolving its issues. Further research into its secondary metabolites, potential genetic changes to improve its favorable traits, and long-term management measures to lessen its invasiveness are all areas of investigation. Furthermore, implementing novel biotechnological approaches may pave the way for their optimal use in pharmacology and environmental restoration.

To summarize, Tradescantia spathacea exhibits the junction of aesthetic appeal, ecological adaptation, and scientific potential. With its diverse applications and distinguishing traits, this plant is a rich resource in both natural and applied sciences. A thorough study of its features and ramifications can lead to sustainable utilization, ensuring that it serves as an asset rather than a burden in the ecosystems in which it lives.

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