Review Article

Phytopharmacological Review of *Urtica dioica*

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ABSTRACT

Urtica dioica, commonly known as stinging nettle. It is a medicinal plant. It belongs to the Urticaceae family. *U. diocia* is widely distributed in temperate and tropical regions of Europe, Asia, and America. The plant's stems and leaves have minute trichomes that release formic acid, histamine, acetylcholine, and serotonin causing temporary skin irritation when touched. These trichomes serve as a natural defense mechanism against insect predators, and they are particularly abundant in locations with high nitrogen and heavy metal levels. Despite its stinging properties, stinging nettle has tremendous ecological adaptability, thriving in a variety of environments including woodlands, riverbanks, and roadsides. Its antioxidative activities and pigment production differ depending on the climate, with colder places showing higher antioxidant properties. A new study of the *U. diocia* plant intends to investigate the amount and composition of polyphenols, carotenoids, chlorophylls, and antioxidant activity in nettle leaves and stalks collected at various phenological stages across distinct settings in Croatia. Morphologically stinging nettle is characterized by soft green leaves arranged oppositely on upright stems, with distinctive features including serrated edges and acuminate tips. The plant produces small greenish or brownish blooms, with male and female flowers bearing stamens or pistils, respectively. The leaves and stems have both non-stinging and stinging hairs, the latter releasing irritant chemicals upon contact with the skin

Keywords: *U. diocia*, Stinging nettle, Phytochemistry, Ecology, Polyphenols.

INTRODUCTION

U. diocia, is herbaceous perennial plant growing in the tropical wasteland and temperate areas around the world [1]. *U. diocia* is a place to the Urticaceae family and the common title of this plant is stinging nettle. It grows 2 to 4 meters high. Stinging nettle has pointed clears out and white to yellowish blooms. The spiked clears out are connected in sets inverse to each other. Recognized characteristics of this plant are serrated, hairy leaves and sting. The genus name Urtica means 'to burn' comes from the Latin verb urere. Stinging hairs present on the stem and leaves which when contact with the skin cause a burning sensation, fever and temporary rash [2]. The species name dioica means two houses. This plant usually has either male or female flowers. The hair of the plant is so small they are almost invisible to the naked eye, are referred to as 'trichomes'. These structures can penetrate the skin and release a mixture that has formic acid (like the venom found in bee and ant stings), histamine, acetylcholine, and serotonin. When these poisons meet the upper layer of skin, they cause uncontrollable itching and burning that long up to 12 hours. These trichomes are converted naturally to offer a defense mechanism against insect predators. Many other regions of native nations with mild temperatures can support nettles. It is common to find them in forests, by rivers or streams, and by the sides of highways. They like open or partially shaded areas with lots of water. Urtica species are widely distributed throughout Europe, North America, and Asia. Both stinging nettle species grow on soil that is high in nitrogen and often occur in soil that has elevated levels of heavy metals and inorganic nitrates [3]. Heavy metals tend to accumulate in the leaves of plants because the plants poorly absorb them.

Regardless, nettle herb is mostly obtained from natural sources. Nettle has remarkable plasticity in terms of its ecological niche and environmental requirements. It thrives in moderate to mild climates, preferring open or somewhat shaded habitats with plenty of moisture, such as forests, riverbanks, streamside's, and roadside verges. The accumulation of polyphenolic chemicals and pigments, on the other hand, is dependent on the interaction of climate and habitat variability[4]. Nettle grown in colder areas seems to have enhanced antioxidative properties because of fortification against oxidative stress. In contrast, extended exposure to elevated temperatures and increased sun radiation promotes pigment production. The study sought to decide the presence and profile of low molecular weight polyphenols, carotenoids, and chlorophylls, as well as antioxidant capacity in wild nettle leaves and stalks collected at three phenological stages (before flowering, during flowering, and after flowering) from 14 different natural habitats found in three regions of Croatia. Stinging nettle has played a vital role in human development throughout history. From the ancient civilizations of Greece and Rome to medieval Europe and beyond, this resilient plant has been highly regarded for its multifarious uses and symbolic significance. To fully appreciate its importance, one must delve into the depths of history and explore how stinging nettle has made its mark.

In ancient Greece, *U. diocia* was prominent in mythology and folklore, often associated with divine symbolism and healing properties. According to Greek mythology, a stinging nettle appeared from the blood of the goddess Athena during her

battle with Medusa, imbuing it with sacred attributes and mystical powers. Greek physicians such as Hippocrates and Dioscorides recognized the medicinal virtues of stinging nettle, prescribing it for various ailments ranging gastrointestinal disorders. Similarly, in medieval Europe, stinging nettle garnered widespread recognition as a versatile plant with diverse applications. Its fibrous stems were used to weave textiles, yielding a durable fabric known as 'nettle cloth' or 'ramie,' prized for its strength and resilience. Moreover, stinging nettle was esteemed as a potent medicinal herb, believed to purify the blood, stimulate circulation, and alleviate joint pain.

Figure 1.1: *U. diocia* L. (leaves)

Figure 1.2: *U. diocia* (Nettle venome)

Figure 1.3: *U. diocia* (Stem view)

1.1 Cultural Significance: Stinging Nettle's Influence on Traditions and Practices

Adding to its ground roots, stinging nettle has persisted in various nations and customs, leaving an indelible influence on folklore, ceremonies, and culinary activities. Throughout continents and civilizations, this modest plant has been revered for its nutritional value, symbolic importance, and folklore connotations. In certain societies, stinging nettles were employed in rites and ceremonies to cleanse the body and soul, being rejuvenation and energy[5]. Furthermore, stinging nettle has long been a part of many areas' culinary traditions, with fragile young shoots and leaves gathered for food. In Italy, stinging nettle is used in traditional recipes such as 'risotto alle article' (nettle risotto) and 'gnocchi di erotica' (nettle gnocchi), which are valued for their earthy flavor and nutritious content. Similarly, in the Balkans and Eastern Europe, stinging nettle soup, recognized as 'supa od Kopriva' or 'zeljanica,' is a beloved comfort food enjoyed for its hearty taste and supposed health benefits.

1.2 Medicinal Marvels: Unravelling Stinging Nettle's Therapeutic Potential

Aside from its cultural importance, stinging nettle has long been prized for its medical capabilities, which have been used by healers, herbalists, and medics throughout history. From ancient cures to current herbal medicine, stinging nettle remains a prominent ingredient in many cultures' pharmacopoeias[6]. Stinging nettle has medicinal potential because of its high concentration of bioactive substances such as vitamins, minerals, flavonoids, and phenolic compounds, which contribute to its anti-inflammatory, antioxidant, and diuretic qualities. These bioactive elements work together to provide a plethora of health advantages, making stinging nettle an effective treatment for a variety of diseases. Stinging nettle is often used in traditional medicine to alleviate arthritis and joint pain [7]. Furthermore, stinging nettle has been studied for its potential role in

managing allergic rhinitis, with research suggesting that its antihistamine and anti-inflammatory effects may help reduce allergy symptoms such as sneezing, itching, and nasal congestion.

1.3 Ecological Role: Stinging Nettle's Contribution to Biodiversity and Ecosystem Health

Stinging nettle, in addition to its culinary and medicinal purposes, is critical to supporting biodiversity and ecosystem health in various ecosystems worldwide. Stinging nettle is a pioneer species that can thrive in a variety of environmental situations, making it a significant resource for insects, birds, and small animals, contributing to the complicated web of life in natural ecosystems [8]. Furthermore, stinging nettle is a dynamic nutrient accumulator, absorbing minerals and organic matter from the soil and storing them in its tissues. When stinging nettle plants die and disintegrate, they return nutrients to the soil, increasing ecosystem fertility and encouraging the development of nearby plants. Besides, stinging nettle exhibits allelopathic effects, producing chemical compounds that inhibit the growth of competing plant species, thereby influencing the composition and structure of plant communities in its vicinity [9]. While some may view stinging nettle as a nuisance weed, its ecological helps to underscore its importance as a keystone species in natural ecosystems, where it plays a pivotal role in shaping environmental dynamics and promoting biodiversity.

Literature review

Saša Đurović, Ivan Kojić., et al. (2024):

Stinging nettle (*U. diocia* L.), a plant found practically everywhere in the world, is one source of phenolic chemicals. This plant is a fascinating and comprehensive subject of research due to its lengthy history of use and intriguing chemical composition. This plant's chemical composition also makes it suitable for use as a food and pigment source in the culinary, pharmaceutical, and cosmetic sectors. Earlier inquiry about distinguished phenolic acids and polyphenolic substances in root, stem, and stinging nettle clears out. Various extraction processes were often used to separate them from the leaves. The extracts were used to further explore biological activity or to create various functional food items. The purpose of this study was to gather and combine all known information about this plant, its chemical makeup, and biological activity, with a focus on polyphenolic chemicals and the activity and mechanisms of their activities. Stinging nettle and its extracts were used to create several beneficial food items and cuisines. According to studies, the polyphenolic profile of extracts is found by the plant as well as the extraction process and solvent used. As a result, the extraction process and later isolation of polyphenolic compounds will be found by the application of the produced material.

Muhammad Niaz, Hafsa Abrar., et al. (2024):

Comprehensive phytochemical research of medicinal plants has shown a vast variety of bioactive chemicals inside plants that have historically been used for medical purposes, revealing a wide range of therapeutic benefits. During the ongoing inquiry, a precise and complete chemical identification process was performed for the Lebanese medicinal herb *U. diocia*. This meticulous method not only supports traditional nettle uses but also underscores the plant's significant medicinal significance. This work adds greatly to our understanding of the plant's chemical makeup, highlighting its value as a resource in pharmaceutical research. The findings support the traditional uses of nettle and highlight the plant's significant medicinal significance. Furthermore, this work successfully isolated and characterized several chemicals from *U. diocia*'s distilled water, methanol, and acetone extracts. This thorough method considerably improves our understanding of the plant's chemical makeup, highlighting its potential as a key resource in medicinal research.

Erick Bahena Culhuac, Martiniano Bello., et al. (2024):

Allergic rhinitis (AR) is a common inflammatory disorder that affects millions of people worldwide, and existing therapies are often linked with serious adverse effects. Natural sources, such as *U. diocia* (UD), are being investigated as safer and more effective alternatives. However, the correct instrument of activity for UD is questionable. The essential interactions were then analyzed using molecular dynamics (MD) simulations, with the free energy of binding computed using Generalized Born and Surface Area Solvation (MMGBSA) and conformational changes examined. Alpha- to cotrienol had a strong affinity and induced beneficial conformational modifications across all targets.

Živilė Tarasevičienė, Miglė Vitkauskaitė., et al. (2023):

Stinging nettle (*U. diocia* L.) is an herbaceous plant that grows all over the world and is used for both food and medicine. Overall, study findings show that the chemical composition and antioxidant activity of stinging nettle aerial parts and roots are affected by growing location, soil, climatic conditions (particularly daylight), collecting time, and other factors. The chemical composition of stinging nettles grown in Lithuania was investigated, as well as the solid-liquid extraction efficiency of leaves and roots using various solvents. In addition, we investigated the extraction efficiency of leaf phenols using 96% methanol under various circumstances. The study found that leaves held more crude fats, non-nitrogen extractives, and total carotenoids than roots, but there was no significant difference in crude proteins or ash content. The most compelling temperature for removing phenols from *U. diocia* L. clears out was 70 °C, while time had no basic effect. The current study's findings revealed that concentrated and binary solvents had varied impacts on phenol extraction efficiency from different stinging nettle components, with extraction temperature playing a more important role than extraction duration.

Fahimeh Zamani-Garmsiri, Masoumeh Akmali., et al. (2023): *U. diocia* Distillate (UDD), also known as Araghe Gazaneh, is traditionally used to treat diabetes. Medical experts have overlooked the potential antidiabetic properties of UDD, despite its widespread usage in traditional medicine. This think about surveyed the effect of UDD on glucose digestion system in diabetic rats. Diabetic bunches appeared with higher levels of FBS and HbA1c. Treatment with UDD decreased FBS and maintained a strategic distance from weight misfortune. A lower FBS level was related to expanded GK and HK movement levels in Rats with diabetes who were treated with UDD. Diabetic rats' G6PD-specific activity was reduced compared to nondiabetic rats, but UDD therapy restored it to normal levels. Diabetic rats showed lower levels of GLUT4 expression compared to nondiabetic rats, while UDD restored normal levels. UDD may have therapeutic benefits on diabetes by increasing glucose metabolism, making it a practical alternative or supplemental therapy option.

Khuma Kumari Bhusal, Saraddha Khasu Magar., et al. (2022): Stinging nettle plants may be found anywhere on Earth. Nettles can be consumed as a vegetable, juice, tea, or used to flavor various foods. Stinging nettles have several health advantages. Nettles have antioxidant, antimicrobial, and pro-health properties in all their components. Stinging nettle has greater levels of tannin, polyphenols, antioxidants, carotenoids, and caloric value. The bioactivities of these functional components might be useful in the prevention of arthritis, rheumatism, and cancer. It is a plant that is edible and has nutritional and therapeutic benefits. The stinging nettle root is used to address

microscopic issues linked with benign prostatic hyperplasia, and the leaves are used to treat arthritis, rheumatism, and allergic rhinitis. Its leaves include a lot of fiber, minerals, vitamins, and antioxidants including carotenoids and polyphenols.

Varun Jaiswal, Hae-Jeung Lee., et al. (2022):

U. diocia (UD) is a multi-functional plant that has been utilized for nourishment and therapeutic since antiquity. The plant has the potential to be used as both fertilizer and biological pest control. It is also employed in the textile and allied sectors due to the high quality of its fibers. The plant has recently attracted a lot of interest due to its diverse biological activity and culinary uses. The antioxidant movement of UD is basic in supporting its fundamental organic activities, counting anticancer, antidiabetic, and anti- inflammatory effects. The antioxidant activity of UD has also been shown to be beneficial in other organs, including the brain, liver, lungs, kidney, ovary, and uterus, and may help protect against disorders connected with these organs. The current study's findings would be useful in gaining a comprehensive understanding of UD's antioxidant ability, as well as guiding future optimization and development for therapeutic applications against key illnesses and disorders.

Shobha Upreti, Jyoti Sankar Prusty., et al. (2021):

We used bioinformatics to test a series of bioactive chemical compounds from Himalayan stinging nettle (*U. diocia*) as effective ACE-2 receptor inhibitors (PDB ID: 1R4L). Atomic docking was utilized to dock an arrangement of agent compounds into the dynamic location range of the target receptor protein utilizing the PyRx virtual screen tool's 0.8 adaptation, and the comes about were inspected utilizing the Revelation Studio visualizer. Using molecular docking analysis, 23 compounds were identified as lead molecules based on their greatest binding affinity. β-sitosterol had the greatest binding affinity (-12.2 kcal/mol) and persistent interactions with the ACE-2 receptor's active site. We explored Urtica, which has an assortment of bioactive chemicals that can target ACE-2, an fundamental protein of the RAS framework and a basic protein for SARS-CoV-2 internalization. Furthermore, we calculated the similitude list of ACE2 to Expert, ADAM17, Mas-R , AT1R, AT2R, collectrin, and DPP4. We chose these proteins for MSA since Pro, ADAM17, Mas- R, AT1R, and AT2R play a noteworthy part in the RAS framework.

History

The discovery of *U. diocia*, sometimes known as stinging nettle, is not credited to one person, but rather to an old botanical knowledge that predates historical records. Indigenous societies in diverse places, each with its ecological setting, separately found the plant's distinguishing characteristics and possible applications (5). As a result, the revelation of the stinging nettle is a portion of the collective history of innate information frameworks. It is a member of the Urticaceae family and a varied lineage of flowering plants. *U. diocia*'s adaptive characteristics, such as stinging trichomes and vigorous growth habits, most likely arose in response to selected pressures in its ecological niche. This includes herbivore defensive systems as well as competitive resource acquisition techniques. The species' adaptation to many temperatures and habitats shows its evolutionary robustness.

The study of *U. diocia*'s evolutionary history gives useful insights into the ecological dynamics and evolutionary factors that have produced this fascinating botanical species [10].

2.1 Early History: Ancient Origins and Traditional Uses

Archaeological evidence reveals that ancient cultures used stinging nettles for food, fiber, medicine, and rituals. In ancient Egypt, stinging nettle was grown along the Nile River's banks and treasured for its nutritional worth and therapeutic benefits.

Hieroglyphic writing reveals its usage in ancient medicine to cure a variety of diseases, and its fibers were woven into textiles, illustrating its versatility in everyday life. Similarly, in ancient Greece and Rome, stinging nettle was significant in mythology, folklore, and medicine. Hippocrates, a Greek physician, recognized its medicinal benefits and prescribed it for diseases ranging from arthritis to gastrointestinal issues [11]. Furthermore, the stinging nettle appeared significantly in Greek and Roman mythology, where it related to heavenly symbolism and regarded as a plant of protection and prosperity. Throughout the Middle Ages, stinging nettle continued to be valued for its diverse applications. Its fibrous stems were woven into textiles, yielding a durable fabric known as 'nettle cloth,' while its leaves and roots were used in traditional medicine to alleviate various ailments.

2.2 Present Day Significance: Rediscovery and Innovation

In the present day, stinging nettle has experienced a revival of interest and appreciation, driven by growing awareness of its nutritional, medicinal, and ecological value. Across the globe, researchers, herbalists, and environmentalists are rediscovering the potential of *U. diocia* and exploring new avenues for its use and conservation. In the realm of nutrition and culinary arts, stinging nettle has appeared as a trendy superfood, celebrated for its rich array of vitamins, minerals, and antioxidants.

Moreover, stinging nettle has garnered attention for its therapeutic properties and potential applications in integrative medicine. Scientific studies have confirmed its anti-inflammatory, analgesic, and diuretic effects, confirming its traditional uses and inspiring new avenues for research [12]. Today, stinging nettle supplements, extracts, and herbal preparations are readily available in health stores and pharmacies, offering natural remedies for conditions such as arthritis, allergies, and urinary tract disorders.

Furthermore, stinging nettle's ecological significance is increasingly recognized in the context of sustainable agriculture and biodiversity conservation. As a nitrogen-fixing plant with dynamic allelopathic properties, stinging nettle plays a crucial role in soil fertility, weed management, and habitat restoration. Endeavors to advance the

development and preservation of stinging bother contribute to the flexibility and supportability of agroecological frameworks around the world [13].

2.3 Prospects: Sustainability, Innovation, and Conservation

As global challenges such as climate change, food insecurity, and biodiversity loss continue to escalate, Stinging Nettle offers a beacon of hope and resilience for communities and ecosystems worldwide. In agriculture and agroecology, stinging nettle holds the potential as a valuable crop for sustainable food production and soil management. Its fast growth rate, low input requirements, and versatile applications make it an attractive option for small-scale farmers, urban gardeners, and agroforestry practitioners looking for resilient and regenerative farming practices [14]. Moreover, stinging nettle's medicinal properties and therapeutic potential are poised to inspire breakthroughs in integrative medicine and pharmacology. Furthermore, stinging nettle's ecological role and conservation significance are increasingly recognized in the context of ecosystem restoration and biodiversity conservation. Efforts to protect and restore natural habitats that support stinging nettle populations contribute to the preservation of biodiversity, soil health, and ecosystem services essential for human well-being [15].

Pharmacological properties

3.1 Medicinal uses and their pharmacological actions of *U. diocia* [16].

Medicinal Use	Pharmacological Action
Anti-inflammatory	Inhibit pro-inflammatory path
Analgesic	Alleviates pain perception
Antioxidant	Scavenges free radicle
Diuretics	Produce more urine
Antihistamine	Block h1 receptor
Hypoglycemic	Reduce blood sugar level
Anti-microbial	Inhibit microbial growth
Anti-viral	Inhibit virus replication
Anti-cancer	Show potential against cancer cell

Traditional uses of *U. diocia*

4. Ethnobotanical Uses of *U. diocia* in Different Cultures:

4.1 European Traditional Medicine:

For ages, European traditional medicine has employed *U. diocia* to treat a range of diseases, including arthritis, rheumatism, and gout. Nettle tea was widely used as a tonic to improve general health and vigor. The plant's leaves were used topically to treat joint discomfort and inflammation.

Native American Medicine: North American indigenous peoples medicinally used stinging nettle, most often as a diuretic and to treat urinary tract infections. The herb also alleviated allergies, asthma, and hay fever symptoms. Furthermore, nettle was used in ancient delivery procedures to induce contractions and alleviate labor discomfort.

4.2 Traditional Chinese Medicine (TCM):

U. diocia, also known as "Xun ma," has been used in traditional Chinese medicine to treat wind dampness, and joint discomfort, and increase blood circulation. Nettle is a cooling plant that is used to treat illnesses caused by high body temperatures, such as skin rashes and inflammatory disorders.

4.3 Ayurvedic Medicine:

In Ayurveda, India's ancient medical system, stinging nettle, also known as "bichu buti," is appreciated for its cleansing powers and capacity to balance the doshas. Nettle is used to cleanse the blood, improve renal function, and cure anemia and skin problems. It is also known as a revitalizing herb and is used to boost energy and lifespan.

5. Historical Medicinal Applications of *U. diocia*:

5.1 Ancient Greece and Rome:

The medicinal properties of *U. diocia* were recognized by ancient Greek and Roman physicians, such as Hippocrates and Galen. Nettle was used to treat various ailments, including arthritis, menstrual disorders, and urinary tract infections. The Roman army reportedly used nettle to keep warm during cold winters by beating themselves with the plant to stimulate circulation and generate heat.

5.2 Medieval Europe:

During the Middle Ages, stinging nettle was a staple in European herbal medicine. It was used to treat joint pain, skin disorders, and respiratory conditions. Nettle soup was a common remedy for spring fatigue and was believed to cleanse the body after the long winter months.

5.3 Traditional Slavic Medicine:

In Slavic folk medicine, nettle was considered a sacred plant with powerful healing properties. It was used to treat anemia, fatigue, and weakness, particularly in women after childbirth. Nettle baths were popular for promoting circulation, relieving muscle pain, and revitalizing the body.

5.4 Native American Cultures:

Indigenous peoples of North America used stinging nettle as a staple food and medicinal plant. It was consumed as a nutritious green vegetable and used to make teas and poultices for various ailments. Bother was utilized ceremonially in ceremonies and as a defensive charm against fiendish spirits.

5.5 Nutritional Benefits:

Stinging nettle or *U. diocia* is a plant that possesses various nutritional advantages and potential medicinal applications. It can be an effective dietary supplement due to its high concentration of essential elements. The plant contains vitamins A, C, and K, which are vital for strengthening the

immune system, collagen formation, and blood clotting. Additionally, stinging nettle contains crucial minerals like calcium, iron, and magnesium, that are essential for bone health, oxygen transport, and enzymatic functions[17]. The plant's protein composition is also noteworthy as it contains several amino acids that are helpful for metabolic processes and tissue repair. Furthermore, dietary fiber contributes to digestive health and may aid in regulating blood sugar levels. *U. diocia* is also known for its potent antioxidant properties, which are attributed to phenolic chemicals that help counter oxidative stress and promote cellular health [18].

Clinical Applications and Evidence-Based Medicine of *U. diocia*.

U. diocia, commonly known as stinging nettle, has garnered significant attention in evidence-based medicine due to its diverse pharmacological properties. Clinical research has explored its potential applications in managing various health conditions, supported by a growing body of scientific evidence. Here, we delve into the clinical applications of *U. diocia* and the evidence supporting its efficacy:

6. Management of Inflammatory Condition [19]

6.1 Osteoarthritis and Rheumatoid Arthritis:

Several clinical trials have investigated the use of *U. diocia* in the management of osteoarthritis (OA) and rheumatoid arthritis (RA). A randomized controlled trial (RCT) verified that nettle leaf extract significantly reduced pain and improved joint function in patients with OA related to placebo. Another RCT found that nettle extract supplementation reduced inflammatory markers and disease activity in patients with RA, suggesting potential benefits in managing autoimmune-mediated inflammation.

6.2 Inflammatory Bowel Disease (IBD):

Initial research suggests that *U. diocia*, commonly known as nettle, may have therapeutic benefits for those suffering from inflammatory bowel disease, including Crohn's disease and ulcerative colitis. Studies conducted on animals have indicated that nettle extracts possess anti-inflammatory properties and may help to regulate immune responses within the gut. Further clinical trials are necessary to evaluate the effectiveness of nettle supplements as an adjunctive therapy for IBD patients. Initial research suggests that *U. diocia*, commonly known as nettle, may have therapeutic benefits for those suffering from inflammatory bowel disease, including Crohn's disease and ulcerative colitis. Studies conducted on animals have indicated that nettle extracts possess anti-inflammatory properties and may help to regulate immune responses within the gut. Further clinical trials are necessary to evaluate the effectiveness of nettle supplements as an adjunctive therapy for IBD patients[20].

6.3 Allergic Rhinitis (Hay Fever):

U. diocia has been traditionally used for alleviating symptoms of allergic rhinitis, such as nasal congestion, sneezing, and itching. Clinical trials have demonstrated the efficacy of nettle leaf extracts in reducing allergic symptoms and improving the quality of life in patients with hay fever. Nettle supplementation has been shown to inhibit histamine release and modulate inflammatory pathways, suggesting its utility as a natural alternative to conventional antihistamines.

6.4 Allergic Asthma:

Preliminary evidence suggests that *U. diocia* may have potential in the management of allergic asthma, a chronic inflammatory condition of the airways. Animal studies have shown that nettle extracts can attenuate airway inflammation and hyperreactivity, possibly through anti-inflammatory mechanisms. Further clinical research is needed to evaluate the efficacy and safety of nettle supplementation in asthma patients and elucidate its mechanism of action.

7. Potential Role in Managing Arthritis and Joint Pain:

7.1 Gout:

U. diocia has been traditionally used for managing gout, a type of inflammatory arthritis caused by uric acid accumulation. Limited clinical studies suggest that nettle leaf extracts may help reduce serum uric acid levels and alleviate gout symptoms, although more research is needed to confirm these findings. Nettle supplementation may complement conventional gout treatment by providing anti-inflammatory and analgesic effects[22].

7.2 Fibromyalgia:

Some evidence suggests that *U. diocia* may offer symptomatic relief in fibromyalgia, a chronic pain disorder characterized by widespread musculoskeletal pain and fatigue. A small clinical trial found that nettle supplementation improved pain scores and quality of life measures in fibromyalgia patients, although larger studies are warranted to validate these findings.

Safety And Toxicity Considerations of *U. diocia*

Stinging nettle, also known as *U. diocia*, is a botanical supplement that has been traditionally used in herbal medicine. Though it is generally safe for consumption, it is important to consider any potential safety and toxicity concerns, particularly when using it for therapeutic or dietary purposes. In this article, we will discuss the possible side effects, precautions, and safety considerations related to the use of *U. diocia*.

8. Adverse Effects and Precautions:

8.1 Skin Irritation:

A stinging nettle, also known as *U. diocia*, can cause skin irritation upon contact with its stinging hairs. If you touch the leaves or stems of this plant, you may experience a temporary stinging or burning sensation, along with redness and itching. Therefore, it is important to take precautions to avoid direct skin contact when harvesting or handling nettle plants and wear protective clothing.

8.2 Gastrointestinal Disturbances:

In some cases, ingestion of *U. diocia* preparations may cause mild gastrointestinal discomfort, such as nausea, stomach upset, or diarrhea.

8.3 Allergic Reactions:

While rare, allergic reactions to *U. diocia* have been reported, particularly in individuals with sensitivities to plants in the Urticaceae family. Symptoms of allergic reactions may include skin rash, hives, swelling, difficulty breathing, or anaphylaxis in severe cases. Individuals with known allergies to nettle or related plants should avoid exposure to *U. diocia* and consult a healthcare professional before using nettle supplements.

9. Drug Interactions: [23]

9.1 Anticoagulant Medications: *U. diocia* may have mild anticoagulant properties due to its vitamin K content and potential effects on blood clotting. Concurrent use of nettle supplements with anticoagulant drugs, such as warfarin or aspirin, may increase the risk of bleeding or bruising. Patients taking anticoagulants should consult their healthcare provider before using *U. diocia* to avoid potential interactions.

9.2 Hypoglycemic Medications:

Preliminary evidence suggests that *U. diocia* may lower blood sugar levels and improve insulin sensitivity. Individuals taking hypoglycemic medications, such as insulin or oral antidiabetic drugs, should monitor their blood glucose levels closely when using nettle supplements to prevent hypoglycemia. Dosage adjustments or close medical supervision may be necessary to ensure safe and effective management of diabetes.

10. Safety Considerations for Specific Populations:

10.1 Pregnancy and Lactation:

Limited safety data are available regarding the use of *U. diocia* during pregnancy and breastfeeding. While nettle has been traditionally used to support pregnancy and lactation, its safety profile in these populations has not been adequately studied. Pregnant or breastfeeding women should exercise caution and consult a healthcare professional before using nettle supplements.

10.2 Children and Elderly Individuals:

The safety of *U. diocia* in children and elderly individuals has not been extensively researched. While nettle is generally considered safe for most adults, dosage adjustments may be necessary for pediatric or geriatric populations. Caregivers should consult a healthcare provider before administering nettle products to children or older adults.

SPECIES

Stinging nettle belongs to the flowering plant family Urticaceae, which has over 500 species. As shown in table no.11.1 the taxonomy report of this herb.

Table 11.1: Scientific classification of *U. diocia* [24].

Monarchy	Plantae
Flowering type	Angiosperm
Cotyledon type	Eudicots
Family	Urticaceae
Community	Article
Kind	Urtica. L
Substitutes name	Hesperocnide

A large number of species previously classified in the genus *U. diocia* are now considered synonyms, with some still classified as subspecies. Genetic evidence suggests that the two Hesperocnide species belong to this genus [25].

1. Urtica atrichocaulis (Hand.Mazz.) C.J. Chen - Innate to the Himalayan locale and southwestern China.

2. Urtica atrovirens Req. ex-Loisel. - Flourishes in the western Mediterranean region.

3. Urtica australis Hook. f. - Endemic to the South Island of New Zealand and its surrounding subantarctic islands.

4. Urtica cannabina L. - Found in Western Asia, extending from Siberia to Iran.

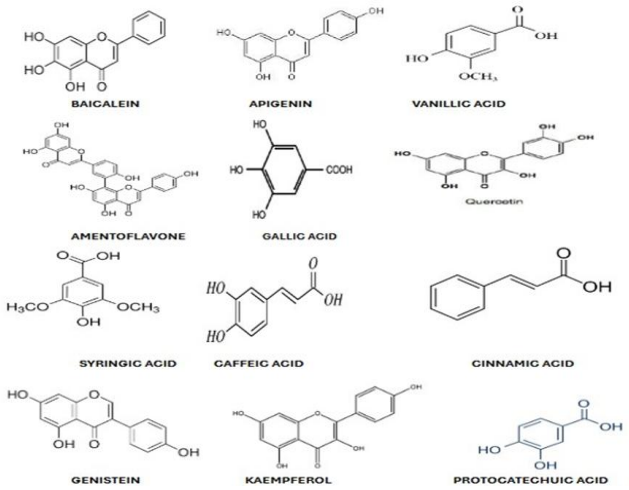
5. Urtica chamaedryoides Pursh (heartleaf nettle) - Primarily found in southeastern North America.

Chemical Composition

U. diocia has a varied chemical makeup that includes several families of phytochemical substances. These compounds contribute to the pharmacological and nutritional qualities of the plant[26-29]. This category contains phenolic acids (like caffeic corrosive and chlorogenic corrosive) and flavonoids (like quercetin and kaempferol), as appeared in Table 11.2. These chemicals have antioxidant capabilities and help the plant's defense processes. It also includes a variety of alkaloids, the most known of which being histamine. When histamine touches the plant's trichomes, it causes a stinging sensation. Stinging nettle contains secoisolariciresinol and other lignans. These chemicals have demonstrated potential health advantages such as anti- inflammatory and antioxidant properties. Besides, they contain essential amino acids, which are required for protein synthesis and other physiological processes in animals. The plant includes vitamins A, C, and K, as well as minerals such as calcium, iron, and magnesium. These contribute to the nutritional composition of the plant. Triterpenes and sterols have been found in *U. diocia* and may be involved in its biological activity. Lipids, especially fatty acids, are found in the plant and contribute to its chemical composition. Complex carbohydrates called polysaccharides found in *U. diocia* have immunomodulatory and other biological effects. Proteins and enzymes are found in plants and perform numerous functions in their physiology.

Table 11.2: Chemical composition of *U. diocia*

Chemical constituents	Approximately Concentration
Phenolic Compound	1-3% of dry weight
Alkaloids	Low concentration
Lignans	Variable concentration
Amino Acid	Essentially present
Vitamins (A, C, K)	Variable concentration
Minerals	Present in a low amount
Triterpenes and Sterols	Present in low amount
Lipids	Trace amount
Polysaccharides	Trace amount
Proteins	Present in low amount



12. Environmental Factors Influencing Phytochemical Composition: [30--33]

12.1 Soil Composition:

Soil composition is vital in influencing the availability of nutrients required for plant growth and development. *U. diocia's* mineral and trace element absorption is influenced by soil pH, nutrient levels, and organic matter content. Variations in soil composition may affect the plant's bioactive chemical production and accumulation.

12.2 Climate and Weather Patterns:

Temperature, precipitation, and sunshine exposure all affect *U. diocia's* growth, development, and metabolism. Different climatic circumstances may influence the expression of genes involved in phytochemical production, resulting in differences in compound concentrations.

Higher temperatures, for example, may increase the production of some secondary metabolites, but heavy rain might dilute phytochemical concentrations.[34-37]

12.3 Geographic Location:

The geographic location of *U. diocia* populations can affect their susceptibility to environmental stresses like as pollution, altitude, and closeness to water sources. Plants grown in urban or industrial locations may acquire heavy metals and other contaminants, which alter their chemical makeup. Furthermore, altitude and climatic changes in mountainous areas might affect plant development and secondary metabolite synthesis.

12.4 Seasonal Changes:

Temperature, sunshine length, and precipitation changes over the growing season can all have a significant impact on *U. diocia's* phenology. Different phases of plant development, such as germination, vegetative growth, and blooming, can have diverse phytochemical profiles. For example, the concentrations of flavonoids and phenolic acids may peak during the blooming stage, although lignan levels may fluctuate throughout the season.

13. Consequences of Variability in Phytochemical Composition: [38-42]

13.1 Therapeutic Efficacy:

U. diocia's phytochemical makeup varies, which can affect its therapeutic efficacy in both traditional and modern medical uses. Depending on the climate, various populations of nettle plants may have greater amounts of bioactive chemicals with strong pharmacological effects. Understanding these differences is critical for selecting plant sources with the greatest medicinal potential.

13.2 Quality Control and Standardization:

The variability in phytochemical content complicates quality control and standardization of *U. diocia* products in the herbal business. Manufacturers must consider environmental issues while acquiring raw materials and creating herbal remedies to maintain consistent potency and efficacy. Standardized extracts and quality assurance processes can assist in reducing the impact of chemical composition variability.

13.3 Research Implications:

Researchers exploring the pharmacological qualities of *U. diocia* must take into account the influence of environmental conditions on phytochemical variability. To provide robust and repeatable results, experimental design and sample selection must be taken into consideration regional and seasonal differences. Comparative research across populations and environmental situations can shed light on the variables underlying phytochemical diversity.

Future Directions and Research Opportunities [43-47]

14. Scope

14.1 Metabolomics Studies:

Recent developments in metabolomics technologies provide an opportunity to understand the intricate interplay between environmental factors and phytochemical composition in *U. diocia*. Through metabolomic profiling, biomarkers related to growth conditions and environmental stressors can be identified, enabling the implementation of specific breeding or cultivation techniques to enhance

desired phytochemicals.

14.2 Ecological Modelling:

Ecological modeling techniques can be employed to predict how climate change and environmental disruptions can affect the abundance and distribution of *U. diocia* populations. By combining ecological data with phytochemical analysis, researchers can evaluate the susceptibility of medicinal plant resources to environmental variability and establish adaptable management strategies.

14.3 Cultivation Practices:

Optimizing cultivation practices for *U. diocia*, such as soil amendments, irrigation methods, and crop rotation, can influence the phytochemical composition and overall plant health. Sustainable cultivation techniques that mimic natural environmental conditions may enhance the production of bioactive compounds while minimizing environmental impacts.

15. Commercial sources and management

Stinging nettle plants have mostly been gathered from nature, but now there is an abundant supply of cultivated plants. Primary producers of stinging nettle include Eastern Germany, the former Soviet Union, Bulgaria, the former Yugoslavia, Hungary, and Albania[48-50]. The Natural Resources Conservation Service (NRCS) of the United States Department of Agriculture (USDA) is a renowned expert in this field [51,52]. They offer various materials such as technical guides and conservation planning documents that provide essential insights into *U. diocia* identification, distribution, and management strategies. These tools are backed by scientific rigor and subject matter knowledge, making them ideal resources for academic research.

16. Establishment in the field

Stinging nettle is a plant that comes in various forms, and it is believed that there are several subspecies. Researchers have assessed 30 different clones of Fiber nettle, and out of all, clone 13 is the most used in recent experimental areas due to its high Fiber content. Stinging nettle can be grown from seed or vegetatively[53-57]. Cultivating stinging nettle can be environmentally beneficial as organic farming techniques can propagate and produce stinging nettle while ensuring sustainable yields. As a perennial crop, stinging nettle requires less tillage, which helps preserve soil richness and structure.

CONCLUSION

Finally, this chapter thoroughly examines *U. diocia*, including its botanical qualities, historical significance, taxonomic categorization, chemical makeup, nutritional advantages, and pharmacological actions. Stinging nettle is a subject of interdisciplinary interest, owing to its interesting botanical properties as well as its persistent cultural importance. Its potential uses in a variety of fields, including medicine, nutrition, and ethnopharmacology, highlight its significance in the current study. This chapter presents an overview of *U. diocia*, encouraging further investigation into its many dimensions and possible contributions to science and human well-being. Stinging nettle *(U. diocia*) has well-documented pharmacological properties due to its phytochemical composition, contributing to various therapeutic effects. *U. diocia* has the potential to manage inflammatory conditions, allergies, skin disorders, and urological issues. Further research is required to ensure safety and efficacy in clinical practice.

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