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SHORT REVIEW ARTICLE

Plant curiosities – Stinging nettle and nature's cure

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Abstract

Though the relationship between nettle (*Urtica dioica)* and dock (*Rumex obtusifolius)* plants is not obligatory, yet it may be said to be peculiar. Both grow as early colonizers near each other on soils which may not be too fertile. While nettle is known for its sting, dock lessens the effect and relieves the pain due to the sting. They are a perfect match and dock leaves have helped many generations of people to counter the effects of nettle stings. In the recent years, scientific investigations have reported that both *Urtica dioica* and *Rumex obtusifolius* are bestowed with healing properties against various illnesses. The present short communication highlights the relationship between the two plants. It also draws attention to the fact that, awareness and documentation of traditional knowledge is important. It also brings focus on the potential of these common weeds as commercial plants with many applications.

Keywords: Histamine; Placebo; Remedy; Stinging Nettles; Trichomes; Urtification

1. Introduction

Plant physiologists and ecologists have been fascinated by the varied perspectives offered by plant stinging hairs. Stinging hairs are documented in more than 600 plant species belonging to five families - Euphorbiaceae (250 species), Losaceae (200 species), Urticaceae (150 species), a few species from Namaceae and one species in Caricaceae (Figure 1A-F). The stinging hairs are categorised into Urtica-type and Tragia type (Ensikat et al., 2021) based on their mechanism of expulsion. The Urtica type of stinging hairs expel only liquid via the classical "hypodermic syringe" mechanism while expulsion in the Tragia-type stinging hairs include liquid and a sharp crystal. Plant stinging hairs are commonly found growing in the wild and one could accidentally come in contact with the stinging hairs. Contact with *U. dioica* usually causes a 'triple response of Lewis' or simply urticaria' (Lahti, 2000). A red spot is formed due to dilation in the capillary. This is followed by dilation in the artery (flaring) and subsequently exuding fluid in to the tissue (welting). The intensity of the sting can be mild irritation or be fatal in humans, dogs and horses (Hurley, 2000). Immediately, after contact with the stinging hairs, a burning pain is felt, which gradually intensifies, and is at the peak after 20-30 minute. This is accompanied by increase in heart rate and swelling and throbbing of lymph glands and the joints, causing pain like that of the sting. The tiny hairs are difficult to remove as the skin often closes over them and the pain aggravates. An immediate remedy to nettle stings is the application of poultice of dock leaves (*Rumex obtusifolius*), which is generally found growing near to *Urtica dioica* in the wild. This mini review is an attempt to decipher the mechanism of *Rumex obtusifolius* in treating nettle stings. It also emphasizes on the importance of documenting traditional knowledge of biodiversity.

2. Nettle – *Urtica dioica*

2.1. The sting and stinging mechanism

Stinging nettles are the most predominant group of stinging plants. It belongs to the genus, *Urtica* of Urticaceae family. The name, *Urtica* is derived from two Latin words, *uro* (to burn) and *urere* (to sting). *Urtica dioica*, commonly referred to as common nettle, burn nettle, burn weed, burn hazel, stinging nettle or nettle leaf, or simply nettle or stinger is the most well-known stinging hair plant of the genus *Urtica*. *U. dioica* is herbaceous, perennial, has widely spreading bright yellow rhizomes and stolons and can easily grow on a variety of soils (Figure 2A-C). The hollow stinging hairs called trichomes are distributed all over on the leaves and stem surfaces (Figure 2D & E). The stem is erect, wiry and green and bears opposite leaves. Leaves are soft, green with serrated margins, and a cordate base. The tip of the leaf is acuminate with the adjacent laterals shorter than a terminal leaf tooth (Figure 2D). The inflorescence is axillary with small, greenish or brownish flowers.

The characteristic feature of the plant is the stinging hairs (Figure 2E, F). They are so special that the plant got its name from their characteristic sting. When the stinging hairs or trichomes rub against the body of any animal or a human being, the microscopic globule at the top of each hair snaps off, leaving hypodermic needles (the trichome minus the tip) to inject irritants into victims skin. The irritants include chemicals such as histamine, serotonin and formic acid, which can flow easily through hollow hair compounding the effect. As a result, the victim has a severe itching and burning sensation (Fu et al., 2006; Brodal 2010; Eniskat et al., 2021). On the other hand, the hairs are the plant's defence mechanism with a double role – first, when they pierce the body, the tip of the hair breaks, it is a mechanical defence and subsequently histamine flows through the hair into the body of the animal, activating a chemical defence.

2.2. Economic and medicinal uses

Though nettles sting, humans have deciphered their uses over the generations. Nettles are consumed as food, used as a source of fibres for cloth, rope and bowstrings and treatment of diseases (Luna, 2001; Awasthi et al., 2024). Stinging nettles are widely used as wild edible plants in many countries. They are a component of soups, curries, or cooked as a vegetable, contributing to community food security and economy of the local people (Adhikari et al., 2016). When young, the nettle leaves are soft, sting less, have high iron and manganese content and are consumed as a vegetable (Upton, 2013). As the plant matures, the concentration of chlorophylls and carotenoids increases. Thus, the young, developing tender leaves are harvested at the onset of spring and preserved by drying, to be used in beer, soups, teas and baked goods (Kregiel et al., 2018). The nettle leaves have a great capacity to retain a significant portion of vitamins A and C, minerals such as calcium and iron, and essential nutrients even after they are blanched or cooked/boiled prior to freezer storage (Chakravartula, 2021). However, vinegar or lemon juice is often added to the cooked nettle to enhance flavour and absorption of minerals (Thorne, 2007). In Georgia, boiled nettle greens

seasoned with walnuts (*Juglans* spp.) is commonly prepared and consumed. Nettle leaf powder/flour has low carbohydrate content but has high amount of fat, fibre, minerals and proteins. In fact, nettle powder contains about three times more protein than wheat and barley and is used as a protein-rich supplement in starchy diets (Adhikari et al., 2016). A low-carbohydrate, high-fibre diet, low in glycemic index nettle powder can support good digestive health. Whole grains of the plant provide much needed fibre to the diet (Perez, 2022). Nettles also possess antioxidant activity owing to the presence of ascorbic acid (AsA), polyphenols, pigments, and minerals (Dujmović et al., 2022).

Nettle patches help in enriching the diversity of the ecosystem. Nettle plants can grow almost everywhere, including wastelands and gardens, which attracting the butterflies, prompting them to expand their territories into gardens and towns (Awasthi et al., 2024). The thick nettle patches can also be an indicator of air pollution boosting soil nitrogen levels owing to their wide range of habitat (Paukszto and Mirosławski, 2019; Singh et al., 2023). The plant also has a tendency to accumulate heavy metals such as chromium and arsenic, and can be a potential phytoremediator (Viktorova et al., 2017).

syrup or tincture from nettle leaves is often used (Joshi and Pandey, 2007; Van Wyk, 2005).

Besides leaves, the roots of nettle plants are also used to treat rheumatic gout, nettle rash, and chickenpox. In addition, they have also been shown to reduce inflammation of prostate gland owing to the presence of phytosterols in them (Ahmed and Parsuraman, 2014; Awasthi et al., 2024; Wambui et al., 2024). Nettle roots have been demonstrated to be safe to relieve lower urinary tract symptoms related to Benign Prostatic Hyperplasia (European Medicines Agency 2012; Khalafi-Kheydani et al., 2022). Further, the extracts from leaves, roots and stems can treat hypertension and diabetes. Certain cases, fasting blood glucose, hemoglobin A1c values and 2-hour postprandial glucose levels were significantly lowered in an insulin taking patient treated with nettle leaf (500 mg capsule of extract) every eight hours for three months (Kianbhakt, 2013).

Nettle fibre is another bioresource and considered the best substitute for cotton that countries like Italy have found (Di Virgilio et al., 2015; Awasthi et al., 2024). Fibres obtained from nettle have low density, waxy surface, and are biodegradable as well as reusable (Brindha et al., 2019). Nettle fibres, have a huge

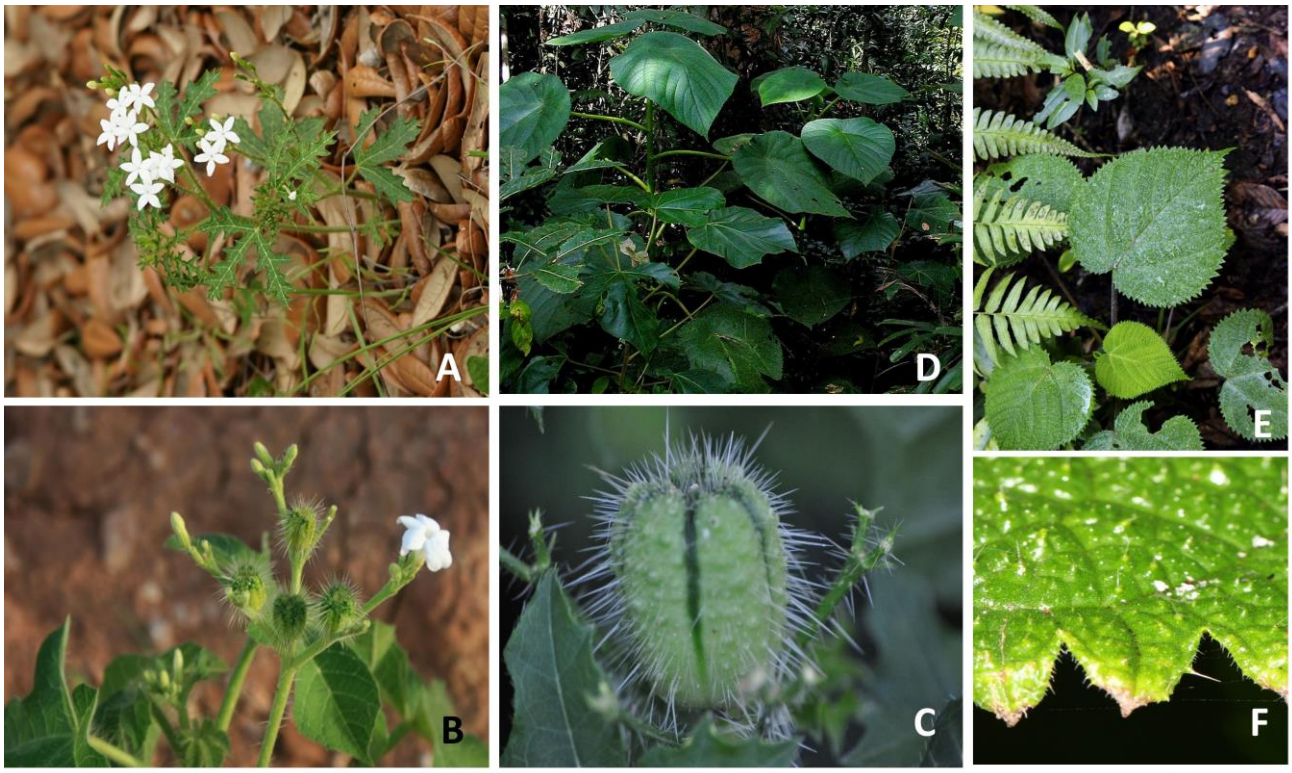

Figure 1. A-F. Plants with stinging hairs.
A-C. Cnidoscolus urens, commonly known as bull nettle. Dense stinging trichomes are clear in (B). Source: A- Hans Hillewaert, CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=15232757
Cnidoscolus urens, one of a number of species called "bull nettle" or "mala mujer", B- Franz Xaver - Own work, CC BY-SA 4.0, https://commons.wikimedia.org/w/index.php?curid=65659858
C – The seed pods also bear stinging trichomes. Source: Schyler at English Wikipedia, CC BY-SA 3.0, via Wikimedia Commons
D – Dendrocnide moroides. The most painful stinging plant. Source: Cgoodwin - Own work, CC BY 3.0, https://commons.wikimedia.org/w/index.php?curid=3380257
E & F. Leaves of stinging tree, Dendrocnide cordifolia. The margin is serrate and surface is clothed with trichomes. Source: Rainer Wunderlich, Creative commons. In (F), the margin is magnified to show stinging trichomes. Source: Woodall, Pete
Supplied as "Pete Woodall" under Creative commons license.

Nettle stings have great therapeutic properties. They are either ingested or the leaves are used to bring placebo effect by deliberately stinging the skin (Randall et al., 2000). One of the ancient practices mentioned in literature is “urtification” (flogging with nettles). It is a process in which fresh stinging hairs are applied externally to induce localized irritation, which in turn stimulates an immune response to relieve pain. This technique is normally used in treating paralytic, rheumatic, stiff limbs, lethargy, coma, paralysis, lower back pain, chronic tendinitis and sprains and even *typhus* and *cholera*. Fresh nettles act as a counter irritant and stimulate blood circulation to provide warmth to joints (Upton, 2013; Silver and Weiner, 2019). To treat urticaria (the rash they produce upon contact with the skin), a

potential to develop fashionable as well as biodegradable textiles (Samanta et al., 2023), thus paving the way for generating a plant-based fibre that doesn’t compete with food production. Traditionally, neetle is used as a biofertilizer and bioinsecticide or as aqueous extract – component of “vegetable soups”, in organic farming (Nygaard and Thorup-Kristensen 2011; Awasthi et al., 2024).

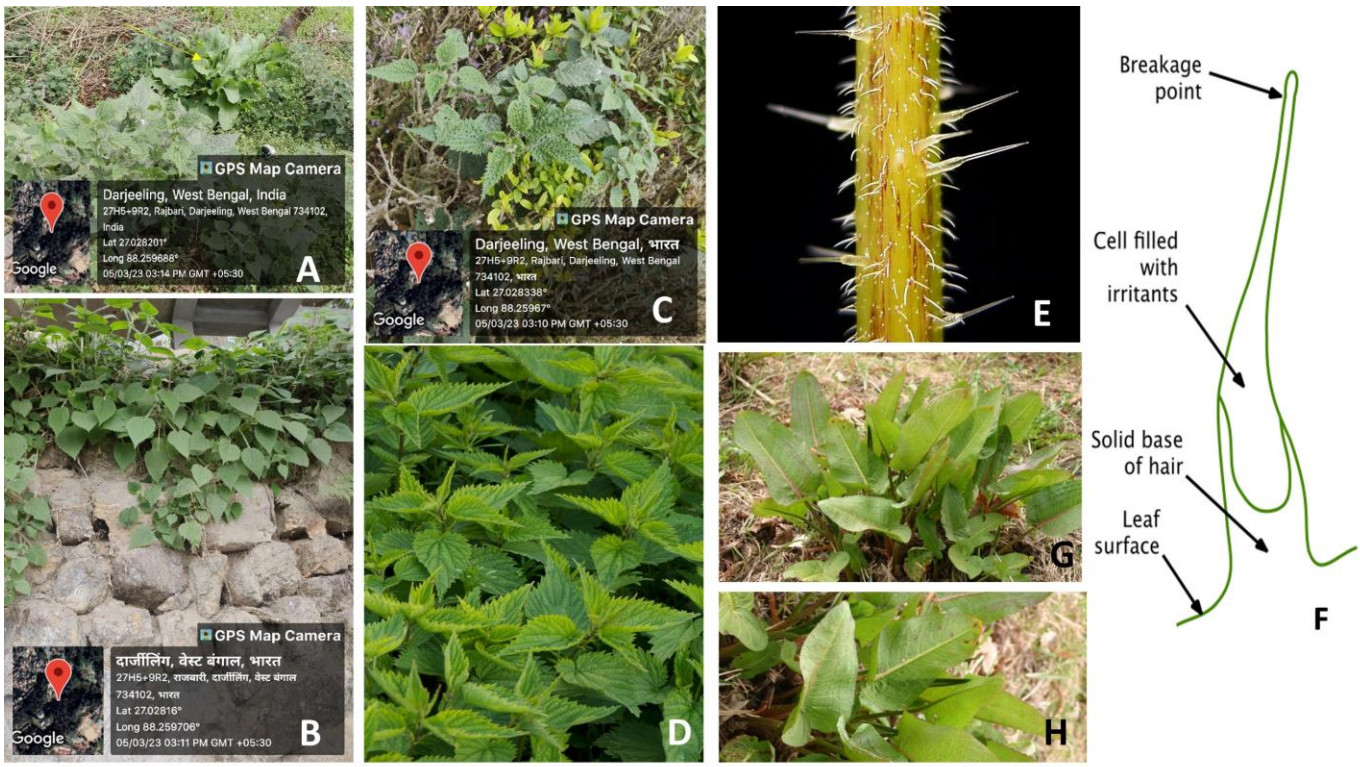

Figure 2. A-F. *Urtica diocia*, G & H. *Rumex obtusifolius*
A – The plants grow close to each other in nature on soils which may not be too fertile.
B – Commonly known as nettle, the plants are also found growing on dry rocks.
C & D – Plants magnified to show the leaves with serrate margins are clothed with trichomes. Source: D - https://creativecommons.org/licenses/by-sa/3.0>, via Wikimedia Commons. Photograph by Sjokolade.
E – The stem also possesses needle like trichomes which provide nettle with mechanical defense. Source: http://creativecommons.org/licenses/by-sa/3.0/; Photograph by Frank Vincentz.
F – Diagrammatic sketch of a trichome showing various parts. Source: https://commons.wikimedia.org/w/index.php?curid=27752919; Photograph by Peter Coxhead.
G & H - The plant shows leaves which are smooth and are cordate in shape; http://creativecommons.org/licenses/by-sa/3.0/>, via Wikimedia Commons. Photograph by Sten Porse.

2.3. Dock – Rumex obtusifolius

Rumex obtusifolius L., belonging to the family Polygonaceae is also known as butter dock because the leaves are used to wrap up butter. Other common names of the plant are bitter dock, broad-leaved dock, blunt leaf dock, dock leaf, and dockens. The leaves are edible and consumed raw as a salad, or cooked as soups (Sganzerla et al., 2019). The plant has various therapeutic properties like, cleansing toxins, and has calming effect, acts as a laxative and diuretic. The plant has also been used in treating anaemia, chronic skin diseases and liver disorders (Gulshan et al., 2012;). *R. obtusifolius* is more commonly known for its curative properties against nettle sting. The plant grows close to the nettle owing to requirements for similar growth conditions (Singh and Sengar 2021) and this may have aided the dock's popularity as a treatment for nettle stings (Mitch 1992; Cummings and Olsen 2011) (Figure 2A).

3. Treating nettle stings with dock

When a person comes in contact with nettle stings, the nettle hairs cause irritation by releasing histamine, serotonin, acetylcholine, formic acid and leukotrienes B4 and C4. Traditionally, a poultice of the leaves of dock is rubbed against the fresh nettle rash or stings to decrease the effect of sting (Figure 2 G & H) (Singh and Sengar 2021). Many theories surround the ameliorative effect of *R. obtusifolius* against nettle sting. According to the traditional folklore medicine, the alkaline nature of dock leaf extract counters the acidic nature of the sting. However, chemical analysis revealed the acidic nature of the dock leaf extract, thus ruling out this theory. Rubbing dock leaf poultice against the sting is believed to act as a distracting counter stimulation (Keith, 2020). Another explanation is the generation of placebo effect, in which rubbing the dock leaf poultice lowers the perception of the sting. Though this effect has no therapeutic value, it may stimulate the body to produce chemicals that relieve the pain (Keith, 2020). Another plant that has been credited with the healing ability of nettle sting is *Aloe vera* (Akbari et al., 2015). It would thus be rewarding to test various other plants for placebo effect and those that grow near stinging plants such as *Dendrocnide*.

Presently, the cure for nettle stings are creams containing antihistamine or corticosteroid that prevent the action of histamine contained in trichomes (Bushal et al., 2022) Calamine based lotions containing zinc oxide and iron (III) oxide act as an anti-pruritic (anti-itching) agent and are used to treat nettle stings (Simon, 2014).

4. Concluding remarks

India has a wealth of plants that provide bioactive compounds. However, most of this resource has not been tapped judiciously for its potential as herbal medicines. Also, many plants have still remained undocumented and underexplored. If these are investigated, it would open new frontiers in pharmaceuticals. The common examples are for snake bites and the action of anti-venom plants which have saved many a life. Many plants such as stinging nettles, growing in the wild are neglected and remain maligned. But recent studies have proven that they are actually nutritional power house, and medicinally important. If researched these plants might turn out to be extremely potent and useful. It is also important that the action mechanism of neurotransmitters in the stinging hairs is also elucidated. Such studies might provide the drug industry with potent medicines which can be used to fight neural diseases.

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Author contributions
Inderdeep Kaur conceptualised the topic and both the authors wrote and revised the manuscript.

Conflict of interest
The authors declare that there are no conflicts of interest.

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