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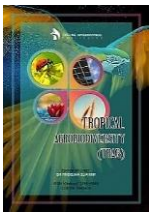

REVIEW ARTICLE

Urtica Dioica: A OSTRACIZED NEGLECTED PLANT IN AGRICULTURE SERVING AS A BEST MEDICINAL AND INSECTICIDAL PROPERTY

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ABSTRACT

Urtica dioica is the flowering herbaceous perennial plant of family Urticaceae distributed globally but commonly considered as a weed in agricultural production. Stinging nettle is one of the emerging plant which has number of medicinal, curative value along with serving as the food and nutritional value in the house of people living below the poverty line. Despite of its million benefit it does not gain much popularity as it deserve. In agricultural production it is considered as weed so removed from the main field. However if the plant is planted in collaboration with other plants it fulfill both nutritive value and serve the main plant with low infestation of disease as pest as stinging nettle avoid the closeness of insect pest as it consist of thorn and also possess host plant resistance characteristics. The plant is only famous in the local rural level and still number of research is to be carried out to transform the globally distributed weed to marketable plant so as to finalize its medicinal value.

KEYWORDS

Urtica dioica, Antioxidant activity, Antimicrobial activity, Stinging nettle, Insecticides, Medicinal, Traditional medicine

1. INTRODUCTION

Urtica dioica is extensively distributed plants commonly popular with the name like common nettle, stinging nettle and burn-nettle. In Nepal the plant is well known from its name as Sisno. Sting nettle is the herbaceous perennial weedy monoecious or dioecious plants with number of stinging and non-stinging tricomes in it. It can grows up to the height of 2 meters with the flower color mainly ranging from green to white blooming either on summer or spring. Leaves and stem of the plant is covered with a Stinging trichomes sometimes also known to be spicules. The leaves consist of fluid which is rich in acetylcholine, amino acid namely histamine and serotonin (Tuberville et al., 1996). The lacunar collenchymatous stem is erect, hairy with green in color. The vascular bundles is Fibrous in nature and generally could be 12–20 (Corsi and Masini, 1997). The upper part of the leaves are dark-green while the lower parts of the leaves is pale which is finely toothed (Testai et al., 2002). Flowering can be visualized during May to September every year (Corsi and Masini, 1997; Ahmed and Parasuraman, 2014). Basically during the august plant produce fruit of achene of either cream or golden color which can be used as source of medicine.

2. PROPAGATION OF NETTLE

Propagation of the plant is quite easy. A dense cluster can be easily formed as the creeping rhizomes that vigorously cover the entire area if planted. One of the best way to establish a new plant is dipping the rhizomes or root on cold water for about 12- 48 hrs. which speeds the rooting process so that plant can be easily established on the main field. However, the plant is still considered as weed so more research has not conducted about the multiplication of the plant. The way of propagation method by dipping in water is identified by the local rural inhabitants who grow the plant in contour region basically on the forest areas when they identified the medicinal properties of the plant. The plant can be propagated by seed.

3. COMPOUNDS PRESENT IN BURN NETTLE

The plant consist of multiple bio-active compounds which can be used for industrial purposes so as to formulate number of medicine. Leaves of sisno is rich in the compounds like polysaccharides, carbohydrates, essential amino acids, fatty acids, vitamins like A, B and C sterols, chlorophyll, carotenoids, minerals like iron, potassium, calcium and magnesium, tannins, isolectins, terpenoids(Rutto et al., 2013). Along with this aerial parts is also rich in polyphenols while the underground parts contains the volatile compounds like steryl glycosides, sterols, and oleanol acid, isolectins and flavonoids(Joshi et al., 2014). These compounds are used for the formulation of medicine, to provide the dietary supplements.

4. DEFENSE MECHANISM OF NETTLE AGAINST FOREIGN ORGANISM

The plant consist of the trichomes on leaf and stems which support as a defense mechanism against most of the pathogen. On the close approaching of the foreign materials the bulbous tips breaks and reveal needlelike tubes which is generally not preferred by the insect and pathogen, thus avoiding the emerging of pest nearby it. This defense mechanism is not only applicable in case of pathogen and pest like aphids but also for higher organism including butterfly, herbivorous and human beings as well. Similarly, when the human being approached near to the plant the bulbous tips break and needlelike tubes pierce the skin resulting in the itching and rashes in the human. Upon bursting of spicules it release the chemicals like serotonin, acetylcholine, histamine and formic acid which on interacting with the human skin goes on the chemical reaction

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thus proceeding towards the allergic effect and cause paresthesia that may remain in the human and animals for of about 12 hours. The gigantic accumulation of stings in the body may result in the poisonous effect ultimately showing the lethal effect. This defense mechanism is the primary reason of considering the plants as the best biological insecticides. The immunomodulation action of *U. dioica* is able to stimulate proliferation and interferon exudation that appears to be attributable to its polysaccharide and lecithin fractions of human lymphocytes (EMA, 2012).

5. Nettle As A Dietary Suppliment

In rural parts of the country this plant is widely used as a source of human food. People used the green leaves so as to prepare the curry. Individual uses the plant not only for the human consumption but as a source of feed for livestock. In the developed countries these plants is also widely used for the formulation of tea. The plant consist of huge amount of protein, carbohydrate, calcium, ash, iron, fiber which fulfill the dietary requirement of the human beings. The plant is rich in vitamin B and C. People mostly used the soup of the plant to reduce the weight (Ji et al., 2009)

6. Medicinal Importance of Nettle

Stinging nettle accounts of the long history in terms of traditional medicine. People from the rural areas often use this plant as a home remedy for cold, against high pressure and sugar. They are widely used as a source of folk medicine. But regardless of the medicinal uses the plant is underestimated on the research basis. People often consider it as a weed and removed from the main field. The root of this plant is used as diuretic and once the external peels is removed can be used to treat against high sugar (Riehemann et al., 1999). Similarly the roots is used to treat prostatic hyperplasia along with other urinary disorder . The plant is used to prepare the tea which is used to treat high fever and arthritis, and gout. The tea is also used as a blood purifier and cleansing tonic .The leaves are pressed and used for urtification that is applied to arthritic joints. It also stimulate the flow of blood. Recently number of creams are prepared from the plant which are used for skin ailments and for joint pain. The leaf extract in the powdered form is used as an anti-hemorrhagic agent. Powdered leaf is used to stop the nose bleeding and menstrual cramp get reduced along with the excessive menstrual flow. External application of the plant is used against hair problems, sciatica, hemorrhoids and neuralgia (Bombardelli et al., 1997). Mostly the medicine is prepared from the extracted flower during May and June which is dried and used for the medicinal purposes. The laxative properties of nettle is used for the treatment of spleen illness and pleurisy and in present days it is used as a herbal drugs in Germany (Bombardelli et al.,1997).

7. Insectidal Properties

Special attention is paid to the antimicrobial activity of the active compounds in nettles and to possible uses of these valuable plants in food and feed formulations. The leaves of Urtica dioica consist of compounds like caffeic acid derivatives and flavonoids which act as analgesic, anti-inflammatory and antioxidant functioning. **(**Chrubasik et al., 2007a). The intercropping of other plant along with U. dioica increase the resistivity of the other plant against bacterial infestation. Nettle is one of the active ingredients for the preparation of botanical pesticides. Along with the ingredients like Artemisia, garlic, chilly, Neem etc. nettle is also used for the preparation. The major function of the plant while preparing the botanical pesticides is it create non preference environment for the insect pest. The needle like structure and thorn present in the leaves when added to the mixture is unfavorable for the insect for ovipositor. Hence resulting in low infestation of insects. Similarly, if the solid particles is as a source of manure it is not preferred by insect.

8. Present Scanario of Nettle

The plant is available throughout the world but almost all plants available are found in the wild form. Even though propagation of the plant is quite easy but the commercial farming has not been started yet because of lack of research. The cost-effective and globally available species could be the best dietary supplement.

Conclusion

Stinging nettles can be found all over the world. Plant hairs located on the leaves and stems contain a number of chemicals, which can cause a stinging reaction and uncomfortable irritation when brought into contact with human skin. Nevertheless, stinging nettles have a number of health benefits and have been used medicinally since at least the times of Ancient Greece. Studies have shown that all parts of the nettle have antioxidant, antimicrobial and pro-health capabilities. Most nettle medicines are made from the flowers, stems and leaves, but roots are also used in pharmacology. This valuable plant has been used most commonly as a diuretic and for treating painful muscles and joints, eczema, gout and anemia. Nettles may be used as a vegetable, in juice, tea and as an ingredient in many dishes. The use of *Urtica* spp. as a feed component could also positively affect the health of poultry and animal productivity. However, despite these proven benefits, the nettle is still an undervalued plant.

Research is continuing into this ordinary plant with unique pharmacological and dietary properties. It is worth investigating the possible wider inclusion of nettles in the daily diet to promote well-being and prevent diseases.

References

Adhikari, B. M. 2016. Comparison of nutritional properties of Stinging nettle (Urtica dioica) flour with wheat and barley flours. Food Science and Nutrition , 4, 119-124.

Adhikari, B., Bajracharya, A., & Shrestha, A. 2016. Comparison of nutritional properties of stinging Nettle (Urtica Dioica) flour with wheat and barley flours. Food Science and Nutrition , 4, 119-124.

Ahangarpour, A., Mohammadian, M., & Dianat, M. 2012. Antidiabetic effect of hydroalcholic Urtica dioica leaf extract in male rats with fructose-induced insulin resistance. Iranian journal of medical sciences, 37(3), 181.

Ahmed, K. M., & Parsuraman, S. 2014. Urtica dioica L.,(Urticaceae): a stinging nettle. Systematic Reviews in Pharmacy, 5(1), 6.

Akg€ul A. Spies Science and Technology. Association Food Technology, Publ. No: 15. Ankara, Turkey, 1993.

AlShuwayeb, M. H., & Al-Khatib, A. J. 2013. Molecular and chemical therapeutic features of Urtica species. European scientific journal, 9(24).

Awad, E., & Austin, B. 2010. Use of lupin, Lupinus perennis, mango, Mangifera indica, and stinging nettle, Urtica dioica, as feed additives to prevent Aeromonas hydrophila infection in rainbow trout, Oncorhynchus mykiss (Walbaum). Journal of fish diseases, 33(5), 413-420.

Awad, E., Austin, B., & Lyndon, A. 2012. Effect of dietary supplements on digestive enzymes and growth performance of rainbow trout (Oncorhynchus mykiss, Walbaum). Journal of American Science, 8(12), 858-864.

Awad, E., Austin, D., & Lyndon, A. R. 2013. Effect of black cumin seed oil (Nigella sativa) and nettle extract (Quercetin) on enhancement of immunity in rainbow trout, Oncorhynchus mykiss (Walbaum). Aquaculture, 388, 193-197.

Baskin CC, B. J. 1998. Seeds: Ecology, Biogeography and evolution of dormancy and germination. p. 666

Bauer, O. N., Pugachev, O. N., & Voronin, V. N. 2002. Study of parasites and diseases of sturgeons in Russia: a review. Journal of Applied Ichthyology, 18(4-6), 420-429.

Baytop, T. 1989. Therapy with Plant in Turkey. Istanbul University, Faculty of Pharmacy.

Benítez, G., González-Tejero, M. R., & Molero-Mesa, J. 2012. Knowledge of ethnoveterinary medicine in the Province of Granada, Andalusia, Spain. Journal of ethnopharmacology, 139(2), 429-439.

Bilen, S., Soydaş, E., & Bilen, A. M. 2014. Effects of methanolic extracts of nettle (Urtica dioica) on non-specific immune response of goldfish (Carassius auratus). Alinteri J. Agric. Sci, 27, 24-28.

Bilen, S., Ünal, S., & Güvensoy, H. 2016. Effects of oyster mushroom (Pleurotus ostreatus) and nettle (Urtica dioica) methanolic extracts on immune responses and resistance to Aeromonas hydrophila in rainbow trout (Oncorhynchus mykiss). Aquaculture, 454, 90-94.

Billard, R., and Lecointre, G. 2001. Biology and conservation of sturgeon and paddlefish. Rev. Fish Biol. Fish. 10, 355–392. doi: 10.1023/A:1012231526151

Binaii, M., Ghiasi, M., Farabi, S. M. V., Pourgholam, R., Fazli, H., Safari, R., & Bankehsaz, Z. 2014. Biochemical and hemato-immunological parameters in juvenile beluga (Huso huso) following the diet supplemented with nettle (Urtica dioica). Fish & shellfish immunology, 36(1), 46-51.

Blumenthal, M., Goldberg, A., & Brinckmann, J. 2000. Herbal medicine. Expanded commission E monographs. Integrative Medicine Communications.

Bombardelli E, Morazzoni P. Urtica dioica L. Fitoterapia. 1997; 68: 387-402

Bonet, M. À., & Valles, J. 2007. Ethnobotany of Montseny biosphere reserve (Catalonia, Iberian Peninsula): plants used in veterinary medicine. Journal of Ethnopharmacology, 110(1), 130-147.

Bradley, P. 1992. British Herbal Compendium. Dorset (Great Britain). Brit. Herb. Med. Ass, 142-144.

Bronzi, P., Rosenthal, H., & Gessner, J. 2011. Global sturgeon aquaculture production: an overview. Journal of Applied Ichthyology, 27(2), 169-175.

Brugère, C., & Ridler, N. B. 2004. Global aquaculture outlook in the next decades: an analysis of national aquaculture production forecasts to 2030 (pp. 1-47). Rome, Italy: Food and Agriculture Organization of the United Nations.

Carella, F., & Sirri, R. 2017. Fish and shellfish pathology. Frontiers in Marine Science, 4, 375.

Chakraborty, S. B., Horn, P., and Hancz, C. 2013. Application of phytochemicals as growth-promoters and endocrine modulators in fish culture. Rev. Aquacult. 5, 1–19. doi: 10.1111/raq.12021

Chrubasik, J. E., Roufogalis, B. D., Wagner, H., & Chrubasik, S. A. 2007a. A comprehensive review on nettle effect and efficacy profiles, Part I: Herba urticae. Phytomedicine, 14(6), 423-435.

Chrubasik, J. E., Roufogalis, B. D., Wagner, H., & Chrubasik, S. 2007b. A comprehensive review on the stinging nettle effect and efficacy profiles. Part II: urticae radix. Phytomedicine, 14(7-8), 568-579.

Chrubasik, S., Enderlein, W., Bauer, R., & Grabner, W. 1997. Evidence for antirheumatic effectiveness of Herba Urticae dioicae in acute arthritis: A pilot study. Phytomedicine, 4(2), 105-108.

Corsi, G., & Masini, A. 1997. Anatomical and ecological aspects in Italian taxa of the genus Urtica. Dipartimento di Scienze Botaniche.

Dar, S. A., Ganai, F. A., Yousuf, A. R., Balkhi, M. H., Bhat, T. M., and Bhat, F. A. 2012. Bioactive potential of leaf extracts from Urtica dioica L. against fish and human pathogenic bacteria. Afr. J. Microbiol. Res. 6, 6893–6899. doi: 10.5897/AJMR12.336

Di Virgilio, N., Papazoglou, E. G., Jankauskiene, Z., Di Lonardo, S., Praczyk, M., & Wielgusz, K. 2015. The potential of stinging nettle (Urtica dioica L.) as a crop with multiple uses. Industrial Crops and Products, 68, 42-49.

Di Virgilio, N., PDi Virgilio N., P. E., Z., J., S., D. L., M., P., & K, W. 2015. The Potential of stinging nettle (Urtica Dioica L.) as a crop with multiple uses. Industrial Crops Production , 68, 42-49.

Disler, M., Ivemeyer, S., Hamburger, M., Vogl, C. R., Tesic, A., Klarer, F., & Walkenhorst, M. 2014. Ethnoveterinary herbal remedies used by farmers in four north-eastern Swiss cantons (St. Gallen, Thurgau, Appenzell Innerrhoden and Appenzell Ausserrhoden). Journal of Ethnobiology and Ethnomedicine, 10(1), 1-23.

Does, M. P., Ng, D. K., Dekker, H. L., Peumans, W. J., Houterman, P. M., Van Damme, E. J., & Cornelissen, B. J. 1999. Characterization of Urtica dioica agglutinin isolectins and the encoding gene family. Plant molecular biology, 39(2), 335-347.

European Medical Agency (EMA). 2012. Assessment Report on Urtica dioica L., Urtica urens L., Their Hybrids or Their Mixtures, Radix. Available online at: http://www.ema.europa.eu/docs/en_GB/document_library/Herbal__HMPC_assessment_report/2012/11/WC500134484.pdf

FAO. 2017. Fishery and Aquaculture Statistics. FAO Yearbook of Fisheries Statistics 2015. Food and Agriculture Organization of the United Nations. Available online at: http://www.fao.org/3/a-i7989t.pdf

Farag, M. A., Weigend, M., Luebert, F., Brokamp, G., & Wessjohann, L. A. 2013. Phytochemical, phylogenetic, and anti-inflammatory evaluation of 43 Urtica accessions (stinging nettle) based on UPLC–Q-TOF-MS metabolomic profiles. Phytochemistry, 96, 170-183.

Farag, M. A., Weigend, M., Luebert, F., Brokamp, G., & Wessjohann, L. A. 2013. Phytochemical, phylogenetic, and anti-inflammatory evaluation of 43 Urtica accessions (stinging nettle) based on UPLC–Q-TOF-MS metabolomic profiles. Phytochemistry, 96, 170-183.

Fischer C. Nettles-an aid to the treatment of allergic rhinitis. Eur Herbal Med. 1997; 3(2): 34-5

FishBase team RMCA and Geelhand, D. 2016. Labeo victorianus. The IUCN Red List of Threatened Species. e.T60318A47182908. doi: 10.2305/IUCN.UK.2016-3.RLTS.T60318A47182908.en

Galelli, A., & Truffa-Bachi, P. 1993. Urtica dioica agglutinin. A superantigenic lectin from stinging nettle rhizome. The Journal of Immunology, 151(4), 1821-1831.

Gesner, J., Chebanov, M., & Freyhof, J. 2010. Huso huso. The IUCN Red List of Threatened Species 2010: e. T10269A3187455.

Gülçin, I., Küfrevioğlu, Ö. İ., Oktay, M., & Büyükokuroğlu, M. E. 2004. Antioxidant, antimicrobial, antiulcer and analgesic activities of nettle (Urtica dioica L.). Journal of ethnopharmacology, 90(2-3), 205-215.

Harikrishnan, R., Balasundaram, C., & Heo, M. S. 2011. Impact of plant products on innate and adaptive immune system of cultured finfish and shellfish. Aquaculture, 317(1-4), 1-15.

Jalali, M. A., Ahmadifar, E., Sudagar, M., & Takami, G. A. 2009. Growth efficiency, body composition, survival and haematological changes in great sturgeon (Huso huso Linnaeus, 1758) juveniles fed diets supplemented with different levels of Ergosan. Aquaculture Research, 40(7), 804-809.

Ji HF, Li XJ, Zhang HY. 2009. Natural products and drug discovery. Can thousands of years of ancient medical knowledge lead us to new and powerful drug com-binations in the fight against cancer and dementia? EMBO Rep. 10(3): 194-200.

Joshi, B. C., Mukhija, M., & Kalia, A. N. 2014. Pharmacognostical review of Urtica dioica L. Int J of G Pharmacy, 8, 201-209.

Kanter, M., Meral, I., Dede, S., Cemek, M., Ozbek, H., Uygan, I., & Gunduz, H. 2003. Effects of Nigella sativa L. and Urtica dioica L. on lipid peroxidation, antioxidant enzyme systems and some liver enzymes in CCl4-treated rats. Journal of Veterinary Medicine Series A, 50(5), 264-268.

Karatas, S., Dügenci, N., and Akin, A. 2003. Some medicinal plants as immunostimulant for fish. Can. J. Ethnopharmacol. 88, 99–106. doi: 10.1016/S0378-8741(03)00182-X

Kembenya, E. M., Marcial, H. S., Outa, N. O., Sakakura, Y., & Hagiwara, A. 2017. Captive breeding of threatened African carp, Labeo victorianus, of Lake Victoria. Journal of the World Aquaculture

Kk, M. A., & Parsuraman, S. 2014. Urtica dioica L.,(Urticaceae): A stinging nettle. Systematic Reviews in Pharmacy, 5(1), 6-8.Society, 48(6), 955-962.

Klingelhoefer, S., Obertreis, B., Quast, S., & Behnke, B. 1999. Antirheumatic effect of IDS 23, a stinging nettle leaf extract, on in vitro expression of T helper cytokines. The Journal of Rheumatology, 26(12), 2517-2522.

Kumar, S., Raman, R. P., Pandey, P. K., Mohanty, S., Kumar, A., & Kumar, K. 2013. Effect of orally administered azadirachtin on non-specific immune parameters of goldfish Carassius auratus (Linn. 1758) and resistance against Aeromonas hydrophila. Fish & shellfish immunology, 34(2), 564-573.

Lans, C., Turner, N., Khan, T., Brauer, G., & Boepple, W. 2007. Ethnoveterinary medicines used for ruminants in British Columbia, Canada. Journal of ethnobiology and ethnomedicine, 3(1), 1-22.

Le Moal, M. A., & Truffa-Bachi, P. 1988. Urtica dioica agglutinin, a new mitogen for murine T lymphocytes: unaltered interleukin-1 production but late interleukin 2-mediated proliferation. Cellular immunology, 115(1), 24-35.

Legssyer, A., Ziyyat, A., Mekhfi, H., Bnouham, M., Tahri, A., Serhrouchni, M., ... & Fischmeister, R. 2002. Cardiovascular effects of Urtica dioica L. in isolated rat heart and aorta. Phytotherapy Research: An International Journal Devoted to Pharmacological and Toxicological Evaluation of Natural Product Derivatives, 16(6), 503-507.

Madhuri, S., Mandloi, A. K., Govind, P., & Sahni, Y. P. 2012. Antimicrobial activity of some medicinal plants against fish pathogens.

Maithya, J., Charo, H., Okeyo-Owuor, J. B., Wangila, B. C. C., Ouma, H., Orinda, C., & Carlsson, M. 2006. Aquaculture strategy for restoration of Threatened Lake Victoria fishes: The case for Oreochromis variabilis (Boulenger, 1906) and Labeo victorianus (Boulenger, 1901).

Mallya, F. F. Katagira, G. Kanggoha, S. B. Mbwana, E. F. Katunzi, J. T. Wambende, N. Azza, E. Wakwabi, S. W. Njoka, M. Kusewa, and H. Busulwa (Dar es Salaam: Lake Victoria Environmental Management Project), 445–466.

Mechanism, General Use and Applications of Nettle. Available in http://www.mdidea.com/products/new/new00914.html

Meral, I., & Kanter, M. 2003. Effects of Nigella sativa L. and Urtica dioica L. on selected mineral status and hematological values in CCl4-treated rats. Biological trace element research, 96(1), 263-270.

Nallan Chakravartula, S. S., Moscetti, R., Farinon, B., Vinciguerra, V., Merendino, N., Bedini, G., ... & Massantini, R. 2021. Stinging Nettles as Potential Food Additive: Effect of Drying Processes on Quality Characteristics of Leaf Powders. Foods, 10(6), 1152.

Ngugi, C. C., Oyoo-Okoth, E., Mugo-Bundi, J., Orina, P. S., Chemoiwa, E. J., Aloo, P. A. 2015. Effects of dietary administration of stinging nettle (Urtica dioica) on the growth performance, biochemical, hematological and immunological parameters in juvenile and adult Victoria Labeo (Labeo victorianus) challenged with Aeromonas hydrophila. Fish & shellfish immunology, 44(2), 533-541.

Nobahar, Z., Gholipour-Kanani, H., Kakoolaki, S., & Jafaryan, H. 2015. Effects of garlic (Allium sativum) and nettle (Urtic adioica) on growth performance and on hematological parameters of beluga (Huso huso). Iranian Journal of Aquatic Animal Health, 1(1), 63-69.

Ogutu-Ohwayo, R. 1990. The decline of the native fishes of lakes Victoria and Kyoga (East Africa) and the impact of introduced species, especially the Nile perch, Lates niloticus, and the Nile tilapia, Oreochromis niloticus. Environmental biology of fishes, 27(2), 81-96.

Özen, T., & Korkmaz, H. 2003. Modulatory effect of Urtica dioica L.(Urticaceae) leaf extract on biotransformation enzyme systems, antioxidant enzymes, lactate dehydrogenase and lipid peroxidation in mice. Phytomedicine, 10(5), 405-415.

Pande, P. C., Tiwari, L., & Pande, H. C. 2007. Ethnoveterinary plants of Uttaranchal—A review.

Randall, C., Randall, H., Dobbs, F., Hutton, C., & Sanders, H. 2000. Randomized controlled trial of nettle sting for treatment of base-of-thumb pain. Journal of the Royal Society of Medicine, 93(6), 305-309.

Raouia Dhouibi, H. A. 2020. Screening of pharmacological uses of Urtica dioica and others benefits. Progress in Biophysics and Molecular Biology , 150, 67-77.

Reverter, M., Tapissier-Bontemps, N., Sasal, P., and Saulnier, D. 2017. Use of medicinal plants in aquaculture, in Diagnosis and Control of Diseases of Fish and Shellfish, 1st Edn, eds B. Austin and A. Newaj-Fyzul (Chichester, UK: John Wiley & Sons Ltd), 223–261. doi: 10.1002/9781119152125.ch9

Riehemann K, Behnke B, Schulze-Osthoff K. Plant extracts from stinging nettle (Urtica dioica), an antirheumatic remedy, inhibit the proinflammatory transcrip-tion factor NF-kappaB. FEBS Lett. 1999 Jan; 442(1): 89-94

Rutto, L. K., Xu, Y., Ramirez, E., & Brandt, M. 2013. Mineral properties and dietary value of raw and processed stinging nettle (Urtica dioica L.). International journal of food science, 2013.

Sovová, H., Sajfrtová, M., Bártlová, M., & Opletal, L. 2004. Near-critical extraction of pigments and oleoresin from stinging nettle leaves. The Journal of supercritical fluids, 30(2), 213-224.

Stinging Nettle – Urtica dioica - Montana Plant Life. Available in http://montana.plant-life.org/species/urtica_dioica.htm

Tara, L. 2001. Propagation Protocol for Stinging Nettle (Urtica dioica). Native Plants Journal , 2, 110-11

Testai, L., Chericoni, S., Calderone, V., Nencioni, G., Nieri, P., Morelli, I., & Martinotti, E. 2002. Cardiovascular effects of Urtica dioica L.(Urticaceae) roots extracts: in vitro and in vivo pharmacological studies. Journal of Ethnopharmacology, 81(1), 105-109.

Türkdoğan, M. K., Ozbek, H., Yener, Z., Tuncer, I., Uygan, I., & Ceylan, E. 2003. The role of Urtica dioica and Nigella sativa in the prevention of carbon tetrachloride-induced hepatotoxicity in rats. Phytotherapy Research: An International Journal Devoted to Pharmacological and Toxicological Evaluation of Natural Product Derivatives, 17(8), 942-946.

Urtica dioica. Available in http://findmeacure.com/2015/06/06/urtica-dioica/ [Last accessed on 12/10/2015].

Wagner, H., Willer, F., & Kreher, B. 1989. Biologically active compounds from the aqueous extract of Urtica dioica. Planta medica, 55(5), 452-454.

Wetherilt, H. 1989. Isırganotu Yaprak ve Tohumlarının Besleyici Özellikleri ve Antitümörel Etkileri (Doctoral dissertation, PhD Thesis,(Turkish). Hacettepe Univ. Graduate Institute of Health Science, Ankara, Turkey).