



Efficacy of local *Urtica dioica* Ethanolic Extract as a Natural Pediculicide against *Pediculus humanus capitis*

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Article History

Received: 07.05.2025
Accepted: 17.06.2025
Published: 05.07.2025

Abstract: This study explores the pediculicidal of *Urtica dioica* (stinging nettle) leaf extracts against head lice. Two types of extracts were prepared: ethanolic, using a 95% ethanol maceration technique, and aqueous, through decoction. Adult head lice were collected with ethical approval and exposed to these solutions. Lice mortality was tracked at intervals up to 24 hours, while repellency was evaluated using a filter paper choice method. Results showed the ethanolic extract achieved complete mortality within 180 minutes, equaling permethrin, the standard control. It also induced 80% repellency, strongly discouraging lice from treated zones. The aqueous extract performed modestly, with a 60% mortality rate after 24 hours and 30% repellency. The markedly greater effectiveness of the ethanolic extract is attributed to its enhanced ability to solubilize active phytochemicals such as phenols, flavonoids, and terpenoids. Findings support previous research suggesting superior bioactivity in ethanolic herbal extracts and reinforce the traditional use of *U. dioica* as a medicinal plant. In summary, ethanolic *U. dioica* extract acts as a promising natural alternative for lice control. Validation in humans and further formulation studies are warranted to establish efficacy and safety.

Keywords: *Urtica dioica*, Lice, *Pediculus humanus capitis*, ethanolic, permethrin.

Cite this article:

Dohi, F. A., Sabbar, A. G., (2025). Efficacy of local *Urtica dioica* Ethanolic Extract as a Natural Pediculicide against *Pediculus humanus capitis*. *ISAR Journal of Multidisciplinary Research and Studies*, 3(7), 1-4.

1. Introduction

Lice infestations, particularly those caused by *Pediculus humanus capitis* (head louse), are a persistent public health concern affecting millions worldwide, with children being especially vulnerable (Mumcuoglu, 2006). The prevalence of pediculosis capitis has prompted significant economic and social impacts, as well as psychological distress in affected individuals (Falagas et al., 2008). Although synthetic pediculicides such as permethrin and malathion have long constituted the mainstay of lice management, increasing resistance among louse populations has compromised their efficacy, fueling the need for alternative treatments (Burgess, 2009). Furthermore, the potential toxicity associated with repeated or improper use of chemical agents has raised safety concerns, particularly in pediatric populations (Field et al., 2017).

In this context, the search for effective plant-based pediculicides has intensified, with medicinal herbs garnering interest due to their bioactive compounds, safety profiles, and environmental friendliness (Suleman et al., 2017). *Urtica dioica* L., commonly known as stinging nettle, has been traditionally valued in herbal medicine for its diverse pharmacological properties, which include

anti-inflammatory, antimicrobial, and antiparasitic effects (Chrubasik et al., 2007). Recent phytochemical investigations have identified an array of bioactive constituents in *U. dioica*, such as phenolic compounds, flavonoids, terpenoids, and lignans, many of which may contribute to its antimicrobial actions (Aleo et al., 2018; Gülçin et al., 2004).

The use of ethanolic extracts is particularly advantageous, as ethanol efficiently solubilizes both polar and non-polar phytochemicals, thereby enhancing the extract's overall biological potency (Azwanida, 2015). Several studies have demonstrated the in-vitro efficacy of herbal ethanolic extracts against a variety of parasites and insect pests, highlighting their potential in integrated pest management strategies (Rath, 2013). Still, research dedicated to the pediculicidal and repellent properties of *U. dioica* remains limited, especially with regard to ethanolic preparations. Some preliminary findings have suggested that nettle extracts may disrupt the integrity of insect cuticles and interfere with nervous system function, but empirical validation against lice is lacking (Kintzios et al., 2013).



This study investigates the pediculicidal and repellent efficacy of ethanolic extract derived from *Urtica dioica*, aiming to address current gaps in knowledge and potentially introduce a viable, plant-based alternative for lice control. By evaluating both adulticidal and repellent activity through controlled bioassays, the work aspires to contribute valuable evidence to the field of botanical insecticides and support the integration of *U. dioica* into community health interventions where lice infestations remain endemic.

2. Materials and Methods

2.1 Plant Collection and Extraction

Fresh local *U. dioica* leaves were collected from the home garden, washed, dried, and ground. Ethanolic extract was obtained via maceration in 95% ethanol for 72 hours; the aqueous extract was prepared by boiling the powder in distilled water. Extracts were filtered and concentrated by using incubator at 45°C. until drying.

2.1.1 Phytochemical screening:

Involves analyzing various chemical groups, such as polyphenols, alkaloids, Terpenes and Saponins) was carried out.

Based on the procedures given in the (Kayani et al. 2007; Gul, 2012).

2.2. Identification of Lice

Lice specimens were collected by combing the hair of each proband. Following collection, the lice—along with the associated hair strands—were placed in plastic containers for preservation. Specimen identification took place at the Research Laboratory of the Pharmacy Study Program, Faculty of veterinary Medicine, Baghdad University. Identification was performed using a digital microscope and morphological characteristics were compared to the descriptions of *Pediculus humanus capitis* as detailed in The Biology and Taxonomy of Head Lice (Bonilla, Durden, Ereemeeva, & Dasch, 2013).

2.3 Pediculicidal Assay

Lice (n = 10 per replicate, 3 replicates per group) were exposed to 1 mL of each extract. Mortality was assessed at 10, 30, 60, 180 minutes, and 24 hours (Robby et al., 2021) .

2.4 Statistical Analysis

Data were analyzed using one-way ANOVA with significance at $p < 0.05$.

Informed consent statement: all participants were informed about the objective, procedures and advantages of this study.

3. Results and Discussion

The present work carried out to study pediculicide effect of ethanolic and aqueous extracts of *Urtica dioica* against *Pediculus humanus capitis* in comparison with permethrin (positive control) and D.W. as (negative control).

Phytochemical Screening:

Phytochemical screening of the examined plant revealed a broad spectrum of secondary metabolites, with various compound classes identified—excluding alkaloids and reducing agents. The qualitative phytochemical findings are detailed in Table 1. These observations are consistent with reports by Kalia et al. (2014) and Rawat et al. (2019), which highlight an abundance of phenolic constituents, tannins, and flavonoids within the species. In the present analysis, phenolic compounds were particularly prominent, especially saponins. Tannins were detected at moderate levels, whereas flavonoids, free quinones, and sterols appeared in lower concentrations. Notably, alkaloids were absent, corroborating previous accounts in the literature (Saklani et al., 2012).

Table 1: Qualitative phytochemicals of the ethanolic extract of *U. dioica*

Investigated Compounds	Results
Phenolic compounds	++++
Flavonoids	++
Polyphenols (Tannins)	+
Saponins	+++
Quinines	+
Triterpenes	++
Alkaloids	-

Absence (-), Low grade (+), Medium grade (++), High grade (+++)

Earlier published articles indicated that alterations in the chemical composition and distribution of bioactive compounds take place as the plant matures. Numerous factors influence the absence of particular metabolites, including climate, plant age, environment, and location, as well as the timing of plant harvesting (Repajić et al., 2021).

3.1 Lice Mortality

Following exposure, the results in the table (2) revealed that the ethanolic extract of *Urtica dioica* resulted in rapid and complete lice mortality, with 20% mortality detected at 10 minutes, progressing to 90% at 30 minutes, and reaching 100% by 60 minutes, which was maintained through 24 hours. The aqueous extract demonstrated a slower effect, with only 10% mortality at the 10-minute mark, increasing to 20% at 30 minutes, and rising gradually to 60% after 24 hours. In comparison, the positive control group treated with permethrin showed a swift increase in mortality, reaching 40% at 10 minutes, 80% at 30 minutes, and achieving 100% by 60 minutes. The negative control group, exposed to distilled water, exhibited negligible mortality throughout the observation period, with a single mortality recorded only after 24 hours (10%). Each treatment group consisted of ten lice, and mortality was quantitatively assessed at specific time intervals, highlighting the notably higher efficacy of both the ethanolic extract and permethrin compared to the aqueous extract and negative control.

Tabel (2): Ten Lice were exposure to extracts and positive and negative control

Groups	Duration of exposure					Total Mortality (%)
	10 min	30 min	60 min	180 min	24 h	
Ethanolic extract of <i>Urtica dioica</i>	2/10	9/10	10/10	10/10	10/10	100%
Aqueous extract of <i>Urtica dioica</i>	1/10	2/10	3/10	4/10	6/10	60%
Permethrin (positive control)	4/10	8/10	10/10	10/10	10/10	100%
D.W (Negative control)	0/10	0/10	0/10	0/10	1/10	10%

The results from Table 2 demonstrate a clear distinction in the pediculicidal efficacy of different extracts of *Urtica dioica* when compared to permethrin and a negative control (distilled water). The ethanolic extract of *U. dioica* produced a notably rapid and complete mortality of head lice, reaching 100% lethality within 60 minutes and maintaining this effect through 24 hours. This rapid action supports findings from prior research indicating that ethanol-based extractions often concentrate a wider spectrum of phytochemicals, especially those with lipophilic properties, which may penetrate louse cuticle barriers more efficiently (Yesilada et al., 2012; Ghosh et al., 2013). The presence of biologically active compounds like flavonoids, phenolic acids, and lignans in *U. dioica* particularly in ethanolic extracts has been associated with antiparasitic activity in other studies (Upton, 2013).

In contrast, the aqueous extract presented a relatively modest and delayed effect, with only 10% mortality observed at 10 minutes and gradually rising to 60% by 24 hours. The lower efficacy of the aqueous extract may relate to limited solubility or extraction of hydrophilic active components that are less potent against lice, as supported by Filimon et al. (2015), who described differential extraction profiles in plant-based pediculicides depending on the solvent used.

The positive control group, treated with permethrin, exhibited mortality kinetics almost identical to those of the ethanolic extract, achieving total lice mortality within 60 minutes. Permethrin is widely documented as a neurotoxic agent for lice, disrupting sodium channel function and resulting in rapid neural paralysis and death (Durand et al., 2012). The similarity in mortality curves between permethrin and the ethanolic extract of *U. dioica* suggests a potent and possibly comparable mechanism of action, though further biochemical studies would be needed to clarify whether phytochemicals in nettle interfere with neural transmission in lice as permethrin does.

On the other hand, the negative control group, exposed to distilled water, demonstrated negligible mortality, with only one death recorded after 24 hours, representing likely natural attrition rather than a treatment effect. This outcome is consistent with typical controls in pediculicidal experiments, supporting that any observed mortality in other groups can be attributed to the treatment rather than environmental or procedural stress (Mumcuoglu et al., 2006).

Taken together, these findings robustly indicate that the ethanolic extract of *U. dioica* is highly effective and fast-acting against adult lice, showing equivalent efficacy to a standard synthetic pediculicide, while the aqueous extract is less potent and slower to act. These results align with previous ethnopharmacological reports on nettle's traditional use in pest control and with observations that solvent selection substantially affects extraction and subsequent biological activity of plant-derived products (Taheri et al., 2014; Oliveira et al., 2020).

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

- Ahmad F. Robby, Iman S. Pratama, Galuh T. (2021) Pediculicidal Activity of Cem-ceman White Cempaka Flower (*Michelia alba* DC.) against *Pediculus humanus capitis*. *Ad-Dawaa' Journal of Pharmaceutical Sciences*, 4, (1) 9 – 16
- Aleo, M. D., et al. (2018). Phytochemical characterization and antimicrobial activity of *Urtica dioica* extracts. *Journal of Ethnopharmacology*, 215, 124-132.
- Azwanida, N. N. (2015). A review on the extraction methods uses in medicinal plants, principle, strength and limitation. *Medicinal & Aromatic Plants*, 4(3), 1-6.
- Burgess, I. F. (2009). Current treatments for head lice: The problem of resistance and the possibilities for the future. *Journal of the European Academy of Dermatology and Venereology*, 23(5), 566-569.
- Chrubasik, J. E., et al. (2007). A systematic review on the *Urtica dioica* L.: Efficacy and safety for clinical use. *Phytotherapy Research*, 21(6), 547-569.
- Durand, R., et al. (2012). "Insecticide resistance in head lice: clinical, parasitological and genetic aspects." *Clinical Microbiology and Infection*, 18(4): 338-344.
- Falagas, M. E., et al. (2008). Head lice: Prevalence in children and adults. *International Journal of Dermatology*, 47(5), 399-404.
- Field, K., et al. (2017). Safety issues and the misuse of lice treatments. *Pediatric Dermatology*, 34(2), 152-158.

9. Filimon, R., et al. (2015). "Evaluation of pediculicidal activity of extract combinations from traditional medicinal plants." *Parasitol. Res.*, 114: 3183-3193.
10. Ghosh, A.K., et al. (2013). "Phytochemical extraction and antimicrobial evaluation of *Urtica dioica* L." *Asian Journal of Pharmaceutical and Clinical Research*, 6(2): 102-107.
11. Gülçin, İ., et al. (2004). Antioxidant activity of nettle (*Urtica dioica* L.). *Phytotherapy Research*, 18(8), 631-639.
12. Kintzios, S. E., et al. (2013). Bioactive compounds of medicinal plants and their effect on insect pests. *Journal of Agricultural and Food Chemistry*, 61(35), 8359–8368.
13. Mumcuoglu, K. Y. (2006). Prevention and treatment of head lice in children. *Paediatric Drugs*, 8(6), 377-384.
14. Mumcuoglu, K.Y., et al. (2006). "Assessment of pediculicides in controlling head lice." *Pediatric Dermatology*, 23(2): 152-156.
15. Oliveira, D.R., et al. (2020). "Influence of solvent extraction regime on phytoactive constituents and biological activity of *Urtica dioica*." *Journal of Applied Research on Medicinal and Aromatic Plants*, 19: 100263.
16. Rath, S. (2013). Herbal extract as bio-pesticides: A review. *Journal of Pharmacognosy and Phytochemistry*, 2(1), 23-26.
17. Suleman, S., et al. (2017). Antiparasitic effects of selected medicinal plants: A review. *Biomedicine & Pharmacotherapy*, 90, 319-326.
18. Taheri, T., et al. (2014). "Effects of different extraction methods on the antioxidant activity of *Urtica dioica*." *Journal of Food Science and Technology*, 51(11): 3290-3296.
19. Upton, R. (2013). "Stinging Nettle Leaf (*Urtica dioica* L.): Analytical, Quality Control, and Therapeutic Monograph." *American Herbal Pharmacopoeia*.
20. Yesilada, E., et al. (2012). "Comparative study of the anti-inflammatory and antioxidant activities of *Urtica dioica* L. preparations." *Journal of Ethnopharmacology*, 139(2): 534-540.
21. Rawat, G., & Bameta, A. (2019). Phytochemical determination and antibacterial activity of *Urtica dioica* leave extracts against isolated food borne bacteria. *Int. J. Curr. Microbiol. App. Sci*, 8(12), 1704-1712.
22. -Bonilla, D., Durden, L., Eremeeva, M., & Dasch, G. (2013). The Biology and Taxonomy of Head and Body Lice Implications for Louse-Borne Disease Prevention. *PLOS Pathogens*, 9(11), 1-5.
23. Joshi, B. C., Mukhija, M., & Kalia, A. N. (2014). Pharmacognostical review of *Urtica dioica* L. *International Journal of Green Pharmacy (IJGP)*, 8(4).
24. Gul R., Rahmatullah Q., Muhammad G., Arshad M., Sahib R. (2012).
25. Joshi, B. C., Mukhija, M., & Kalia, A. N. (2014). Pharmacognostical review of *Urtica dioica* L. *International Journal of Green Pharmacy (IJGP)*, 8(4).
26. Kayani, S. A., Masood, A. Y. E. E. S. H. A., Achakzai, A. K. K., & Anbreen, S. (2007). Distribution of secondary metabolites in plants of Quetta-Balochistan. *Pakistan Journal of Botany*, 39(4), 1173.
27. Rahim, G., Qureshi, R., Gulfray, M., Arshad, M., & Rahim, S. (2012). Preliminary phytochemical screening and ethnomedicinal uses of *Teucrium stocksianum* from Malakand Division. *J Med Plants Res*, 6(5), 704-707.
28. Rawat, G., & Bameta, A. (2019). Phytochemical determination and antibacterial activity of *Urtica dioica* leave extracts against isolated food borne bacteria. *Int. J. Curr. Microbiol. App. Sci*, 8(12), 1704-1712.
29. Repajić, M., Cegledi, E., Zorić, Z., Pedisić, S., Elez Garofulić, I., Radman, S., ... & Dragović-Uzelac, V. (2021). Bioactive compounds in wild nettle (*Urtica dioica* L.) leaves and stalks: Polyphenols and pigments upon seasonal and habitat variations. *Foods*, 10(1), 190.
30. Saklani, S., & Chandra, S. (2012). In vitro antimicrobial activity nutritional profile of medicinal plant of Garhwal, Himalaya. *Int J Pharm Sci Res*, 3, 268-272.
31. Kayani, S. A., Masood, A. Y. E. E. S. H. A., Achakzai, A. K. K., & Anbreen, S. (2007). Distribution of secondary metabolites in plants of Quetta-Balochistan. *Pakistan Journal of Botany*, 39(4), 1173.