Review Article

Antioxidant and Anti-inflammatory Activities of *Paronychia Argentea* (Algerian Tea)

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Abstract

In the intricate dance of health and imbalance, oxidative stress and inflammation emerge as central players, contributing to a spectrum of physiological disorders. This review delves into the therapeutic potential of *Paronychia argentea* (aka Algerian Tea), a perennial plant deeply rooted in traditional medicine, aiming to unravel its antioxidant and anti-inflammatory attributes, along with exploring its polyphenolic and flavonoid constituents. Studies consistently affirm its efficacy in mitigating inflammation, combating free radicals, and providing nephroprotective and antimicrobial benefits. The multifaceted bioactive compounds within the plant position it as a promising candidate for pharmaceuticals, nutraceuticals, and personal care products.

Keywords: Paronychia argentea, plant, antioxidant, anti-inflammatory activities, traditional medicine

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Introduction

Oxidative stress ensues when the delicate equilibrium between reactive oxygen species production and antioxidant presence is disrupted. This imbalance precipitates damage to biomolecules—proteins, lipids, and nucleic acids—culminating in cell death and contributing to a spectrum of physiological disorders, including cancer, diabetes, asthma, premature aging, and the intricate landscape of cardiovascular, neurodegenerative, and inflammatory diseases.[1,2] Conversely, inflammation emerges as a central protagonist in diverse pathophysiological narratives, acting as both a response to tissue injuries and a defense mechanism against exogenous threats.[3] Pro-inflammatory cells, notably activated macrophages, orchestrate the cellular and molecular symphony of inflammatory pathophysiologies. Their performance includes the production of cytokines and other pro-inflammatory molecules, such as prostaglandins and free radicals like nitric oxide, intricately woven into the pathogenesis of chronic diseases like multiple sclerosis, Parkinson's disease, Alzheimer's disease, and colon cancer.[4,5]

In this intricate dance of health and imbalance, free radicals assume the role of significant mediators, either triggering or sustaining inflammatory processes. The narrative unfolds as antioxidants emerge as protagonists, neutralizing these free radicals and alleviating inflammation. Additionally, certain anti-inflammatory compounds reveal dual roles, showcasing antioxidant effects and mechanisms for scavenging free radicals.[6,7]

Amidst this scientific tapestry, a significant portion of the global population finds solace in traditional medicine, anchored in medicinal plants playing a pivotal role in health preservation.[8,9] Derived from plants or plant-origin molecules, several drugs form a crucial part of this healing narrative. Recognized as abundant sources of antioxidants like phenolic compounds, anthocyanins, and flavonoids, plants contribute significantly to the food industry. The widespread acknowledgment prevails that the consumption of plant-based antioxidants can mitigate the risk of various human diseases linked to oxidative stress.[10]

Now, a pivotal character in this narrative is

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Paronychia argentea (aka Algerian Tea), deeply rooted in traditional practices, entrusted with the task of treating or preventing a myriad of diseases – from urolithiasis, kidney diseases, and diabetes to gastric ulcers, anorexia, and heart pains.[11] Despite its traditional acclaim, studies elucidating the pharmacological effects of this plant remain notably limited. This prompts the objective of our review: to meticulously evaluate the antioxidant and anti-inflammatory activities and unravel the polyphenolic and flavonoid contents of Paronychia argentea, enriching the ongoing scientific discourse on the potential health benefits of this traditional botanical remedy.

Methods

Study Selection: For the identification of relevant studies, a thorough and comprehensive search was conducted across multiple electronic databases, including PubMed, ScienceDirect, and Google Scholar. The search strategy involved the use of relevant keywords and controlled vocabulary related to Paronychia argentea, oxidative stress, and inflammation. Boolean operators and search filters were applied to refine the search results and enhance specificity.

Inclusion and Exclusion Criteria: The selected articles were required to specifically address the role of Paronychia argentea in oxidative stress and inflammation. Inclusion criteria comprised studies that explicitly focused on Paronychia argentea as the primary subject of investigation, whether in the form of whole-plant extracts or isolated compounds. Additionally, studies were considered eligible if they investigated the effects of Paronychia argentea on oxidative stress and inflammation parameters. The inclusion extended to diverse experimental designs, encompassing both in vitro and in vivo studies, as well as clinical trials. Animal models or cellular systems that accurately represented physiological conditions related to oxidative stress and inflammation were included in the scope. Publication types encompassed peer-reviewed articles, reviews, and systematic reviews to ensure a comprehensive understanding of the topic.

Studies were excluded based on the following criteria to ensure the selection of relevant and methodologically sound research for the review. First, studies that did not investigate oxidative stress and inflammation or those concentrating on unrelated aspects of Paronychia argentea were excluded. Second, studies lacking essential data on oxidative stress and inflammation parameters or those with insufficient experimental details were excluded to maintain methodological rigor. Third, articles not published in English were excluded due to language proficiency limitations. Finally, non-original research articles, including editorials, opinions, and case reports, were excluded to maintain the review's focus on scientific evidence. These comprehensive exclusion criteria were employed to refine the selection process and ensure the inclusion of studies meeting the specific criteria outlined for the review.

Presentation of the Plant: *Paronychia argentea L.*

Description and Characterization: Paronychia argentea (aka Algerian Tea), a perennial plant from the Caryophyllaceae family. It manifests as a herbaceous plant, spreading 30 to 50 cm in length, forming a mat with jointed, elongated, and pubescent features adorned with short hairs.[11] The leaves, measuring up to 5 mm by 2 mm, are lanceolate-linear, occasionally oval with acute tips and lacking hair. The calyx lobes are oblong, featuring membranous hooded margins concluding in sharp awns. Its silver-white flowers, densely distributed amidst the leaves, form lateral and terminal heads. The flowering phase spans from April to June, with the plant thriving in dry, sandy, and gravelly soils, favoring sunny exposures. Indigenous to the Iberian Peninsula, France, the Apennine Peninsula, the Balkan Peninsula, Turkey, the Levant, Southwest Asia, and North Africa, Paronychia argentea is deeply embedded in diverse geographical landscapes.[12,13]

Naming and Taxonomy: Paronychia argentea, meticulously described and named by Jean-Baptiste Pierre Antoine de Monet de Lamarck in 1805, encapsulates its essence.[14] The nomenclature weaves a tale rooted in ancient Greek and Latin origins. "Paronychia" derives from the Greek compound: παρωνυχία, signifying an abscess near the nail akin to paronychia disease, aligning with the nail-like shape of the plant's calyx. "Argentea" traces its roots to the Latin terms "argenteus" or "argentum" = silver (silver color, silvery).[15] Consequently, the plant resonates with diverse common names: (Arabic: Kessaret lahdjar, Fettat lahdjar, Bsat elmoulouk)

(French: Herbe-au-panaris, Paronyque argentée, Thé arabe), (English: Silver Nailwort, Silvery Paronychia, Whitloewort, Mountain-knot-grass, Algerian Tea)

Taxonomy of Paronychia argentea Lam.

Kingdom: Plantae

Division: Magnoliophyta

Phylum: Phanerogams

Subphylum: Angiosperms

Class: Eudicotyledons

Order: Caryophyllales

Family: Caryophyllaceae

Genus: Paronychia

Species: Paronychia argentea

Biological Properties and Toxicity: In the realm of traditional medicine, *Paronychia argentea* emerges as a potent ally against various ailments, including urolithiasis[16] North African folk medicine extensively utilizes its aerial parts to address renal diseases and diabetes.[17,18] Beyond, it finds application as a gastric analgesic, addressing stomach ulcers, anorexia, flatulence, abdominal diseases, bladder and prostate diseases, kidney stones, and heart pains.[19-21]

The renal protection and anti-urolithiatic effects of Paronychia argentea, demonstrated by Bouanani et al.[22] affirm its medicinal prowess. Belarbi et al.[23] identified *Paronychia argentea* as a potent anti-precipitant for calcium carbonate (CaCO3), bolstering its traditional application in treating kidney stones. Complementary studies underscore the hypoglycemic activity of the plant, attributed to the inhibition of α-amylase by its diverse flavonoid aglycones and glycosides.[11] Multiple research endeavors have validated the antioxidant activity of *P. argentea*'s alcoholic and aqueous extracts through various antioxidant tests.[24,25] Additionally, other study showed high antimicrobial activity of the ethanolic extract against Bacillus subtilis, albeit low activity against Escherichia coli.[26]

Toxicological analyses conducted by Bouanani et al.[22] in rat models shed light on the safety profile of *P. argentea*. Oral administration of extracts did not induce significant alterations in biochemical and hematological parameters, and no toxic symptoms or deaths occurred during the 14-day experiment. Consequently, the minimum lethal dose (LD50) of the aqueous and butanolic extracts of the aerial part of *P. argentea* exceeds 2000 mg/kg and 40 mg/kg, respectively.[22]

Chemical Composition: The aqueous extract of *P. argentea* boasts a rich composition, featuring flavonoids, phenolic compounds, and terpenoids.[27] Notably, alkaloids are conspicuously absent in the phytochemical analysis of this extract. Other study showed that the flavonoids in the decoction of *P. argentea* were meticulously analyzed, revealing eleven compounds, six of which were identified in this plant for the first time (isorhamnetin, isorhamnetin-3-O-dihexoside, quercetin, quercetin-3-O-glucoside, quercetin-methyl-ether-O-hexoside, and jaceosidine). This detailed characterization holds promise in validating the plant's applications in traditional medicine.[16]

Antioxidant and Anti-inflammatory Activities: *Paronychia argentea* manifests notable antimicrobial and antiviral capabilities, fortifying the body's defenses against infections and diseases. Its positive effects extend to supporting healthy digestion, attenuating inflammation, and ameliorating conditions such as acne, eczema, and psoriasis.[28,29] The anti-inflammatory features of the plant prove valuable in addressing swelling and pain, thereby diminishing the likelihood of heart and kidney diseases. Additionally, Paronychia argentea actively supports immune system function, reinforcing the body against diverse health threats.[11,22]

Numerous investigations consistently affirm the remarkable antioxidant and anti-inflammatory attributes inherent in Paronychia argentea, attributable to its abundance of polyphenols, flavonoids, and carotenoids.[30-32] These bioactive constituents play a pivotal role in mitigating inflammation and combating free radicals. Ingestion of *Paronychia Argentea* correlates with diverse health benefits, encompassing the mitigation of inflammation, prevention of chronic diseases, and overall enhancement of well-being. Notably, its antioxidant prowess contributes to a reduced susceptibility to specific cancer types. The diverse array of bioactive compounds within *Paronychia Argentea* underscores its potential as a natural remedy. From skincare to digestive health and immune system support, its multifaceted properties position it as a promising

botanical resource with extensive applications in pharmaceuticals, nutraceuticals, and personal care products. Further exploration is imperative to unveil additional insights into its comprehensive range of health benefits.[11]

Many studies suggest that *P. argentea* exhibits substantial antioxidant potential, as demonstrated by its capacity to scavenge reactive oxygen species (ROS) and modulate antioxidant enzyme activity. Moreover, this review delves into the anti-inflammatory effects of *P. argentea*, elucidating its impact on inflammatory cytokines and markers. Research has unveiled the significant antioxidant activity of *Paronychia argentea* in various in vitro assays, including DPPH, ABTS, CUPRAC, FRAP, and Phenantroline assays.[24] These findings underscore the presence of compounds within the plant extract capable of efficiently neutralizing free radicals and mitigating oxidative stress within the biological system. Additionally, the plant extract has exhibited inhibitory activity against xanthine oxidase, further reinforcing its potential as an antioxidant agent.[29-31]

Beyond its antioxidant potential, *Paronychia Argentea* showcases promise in the realm of anti-inflammatory activity. Studies have elucidated its capacity to inhibit diverse inflammatory markers and pathways, indicating its potential to modulate the body's inflammatory response. This is particularly noteworthy in chronic inflammatory conditions, where the plant's compounds may alleviate excessive inflammation and its associated health implications.[24,32-34]

Moreover, the plant has exhibited nephroprotective activity, offering protection against oxidative damage to renal endothelial cells, which holds potential for treating renal diseases. Additionally, it has demonstrated antimicrobial activity against a broad spectrum of microorganisms.[11,34] Last but not the least, several studies showed that the fractions of the total extract of this plant has high potency in treatment of kidney stones (calcium oxalate and calcium phosphate); mainly those fractions contains non-polar and semipolar compounds of this plant.[35,36]

Conclusion

In conclusion, the cumulative research furnishes compelling evidence for the antioxidant and anti-inflammatory potential of Paronychia argentea. Its rich polyphenolic and flavonoid contents, coupled with observed bioactive properties, position it as a promising candidate for further exploration in the development of natural antioxidants and anti-inflammatory agents. However, additional research is indispensable to pinpoint the specific biologically active molecules responsible for these effects. This synthesis consolidates existing insights into the antioxidant and anti-inflammatory activities inherent in Paronychia argentea, providing a nuanced perspective on its therapeutic potential. The delineated polyphenolic and flavonoid constituents not only affirm its traditional applications but also beckon further exploration, offering promise for harnessing its benefits in contemporary medicine.

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