Neem Research Newsletter

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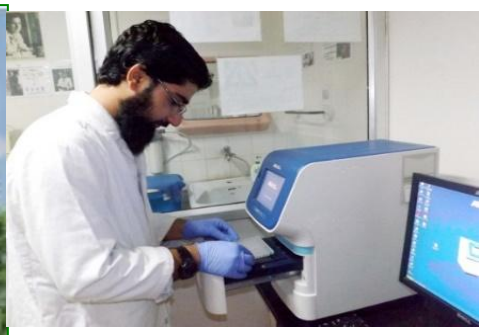
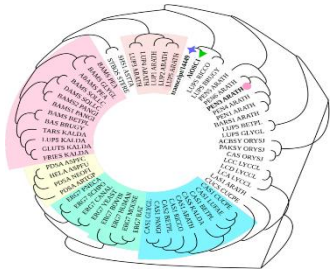




WORLD NEEM ORGANISATION (WNO)

From

The Editor's Desk……

After successful conduct of the WNO Neem Summit-2026, in Pune on Mar 13 and 14, we move forward with renewed vigour and aspirations. It gives me immense pleasure to present the latest research findings on the Neem front.

A terpenoid-based azadirachtin nano-formulation (Terpaz®, TNF) was demonstrated to significantly suppress nematode population densities, reduce galling, and enhance tomato yield, outperforming synthetic nematicides without inhibitory effects on beneficial soil microbes. Azadirachtin was found to be effective in a green integrated pest management system centered on biological control for tea plant pests. Green-synthesized silver nanoparticles synthesized using neem leaf exerted promising antiparasitic effects against Argulus siamensis, that infests Labeo rohita suggesting possible application in freshwater aquaculture.

Ethyl cellulose/poly(ethylene oxide) fibrous films incorporated with nitrogen-carbon dots using neem leaves as the precursor were shown to be useful as sustainable packaging material with enhanced UV resistance and antioxidant characteristics for preserving fresh-cut fruits.

Myrrh and neem extracts showed promising antimicrobial potential as root canal disinfectants and may serve as effective alternatives to conventional chemical endodontic irrigants. It is noteworthy that Neem was listed in a systematic review of the efficacy and safety of herbal extracts in denture care based on its significant antifungal and antimicrobial activity, improved denture retention and mucosal health. A scoping review on the utilization of medicinal plants to manage maternal conditions among Tanzanian women included Neem as a frequently cited plant. Evaluation of a Thai traditional anti-abscess herbal formulation comprising *Curcuma zedoaria*, *Vitex trifolia*, and *Azadirachta indica* indicated that the formulation has measurable antioxidant activity and targeted antibacterial efficacy that can attenuate abscess progression via interference with biofilm regulation. In another study, neem leaf extract was reported to exhibit stronger antiviral potential, markedly enhancing necrotic responses in hepatitis B and C virus-infected peripheral blood mononuclear cells obtained from patients compared to drumstick leaves. Gedunin, a neem limonoid in combination with glucantime showed potential antileishmanial effects and enhanced host immune response. Scientists provided evidence that the neem limonoid, nimbolide inhibits the molecule implicated in the causation of bone erosion in osteoporosis. The potential of neem in alleviating diabetic foot infection was highlighted in a review on herbal therapies. In a comprehensive analysis of 638 medicinal plants from 32 ethnopharmacological studies conducted in eight West African countries neem is among the twelve most cited plants for the management of diabetes. In mice bearing breast cancer, carbon quantum dots derived from neem were found to be efficacious in tumor remission. In another study, epoxyazadiradione was demonstrated to possess greater cytotoxic effects against pancreatic cancer by triggering cell death compared to azadirachtin. Furthermore, a series of novel epoxyazadiradione-thiazole hybrids exhibited significant cytotoxic activity against cancer cells.

In crossbred male goats., dietary supplementation of purple neem leaf enhanced growth, feed intake, nutrient digestibility, and antioxidant activity demonstrating strong potential as a natural feed additive for improving health and productivity. A 1% neem oil spray was found to be effective for controlling mites in scorpions maintained for venom production indicating that neem oil provides an effective, safe, sustainable, and low-cost acaricidal option for scorpions under human care, with benefits for venom yield and animal welfare.

S. Nagini

Core Founding Member, WNO
Chief Scientific Coordinator & Regional Director, South India

Mechanistic elucidation of a terpenoid nano-bionematicide for the management of root-knot nematodes, Meloidogyne incognita infecting tomato.

Arunachalam L, Lakshmanan S, Ganeshan S.Sci Rep. 2026 Mar 3. doi: 10.1038/s41598-026-41775-x. Online ahead of print.PMID: 41775846

Plant-parasitic nematodes, particularly *Meloidogyne incognita*, represent a major constraint to global vegetable production and cause substantial yield losses. Although azadirachtin exhibits strong nematicidal potential, its practical application is limited by instability under field conditions. In this study, a terpenoid-based azadirachtin nano-formulation (Terpaz®, TNF) was developed and evaluated through an integrated approach encompassing physicochemical characterization, in vitro bioassays, molecular docking and molecular dynamics simulations, enzyme inhibition assays, root invasion studies, field evaluation, and biosafety assessment. The characterisation of TNF exhibited a nanoscale droplet size (79.69 nm) with narrow PDI (0.17). In vitro assays revealed substantial inhibition of egg hatching (up to 91.3%) and juvenile mortality (up to 88%), outperforming the synthetic nematicide fluopyram at equivalent doses. Molecular docking demonstrated a strong binding affinity of azadirachtin to acetylcholinesterase (AChE, − 5.37 kcal/mol) and ATPase (–4.8 kcal/mol), which was further supported by stable molecular dynamics trajectories. Enzyme assays confirmed dose-dependent inhibition of AChE (65.7%) and ATPase (73.4%) activities, validating the dual-target mechanism. Root penetration studies showed that TNF at 5 mL/L prevented juvenile invasion beyond the epidermis. Field trials demonstrated that TNF significantly suppressed nematode population densities (Pf = 1.5 J2/g soil), reduced galling, and enhanced tomato yield (25,400 kg/acre), outperforming the synthetic nematicide. Importantly, TNF showed no inhibitory effects on beneficial soil microbes. Collectively, this study establishes TNF as an effective, environmentally safe, and multi-targeted bionematicide, offering a promising sustainable alternative for *M. incognita* management in horticultural crops.

Short-Term Feeding Disruption Effects and Efficacy of Six Biopesticides Against *Empoasca onukii* (Hemiptera: Cicadellidae).

Jia Z, Yang C, Liu Y, Yang Y, Zhou R, Cheng Z, Geng S, Xu Y, Chen Z, Qiao L.Biology (Basel). 2026 Mar 4;15(5):419. doi: 10.3390/biology15050419.PMID: 41823846

Empoasca onukii severely damages tea plants as a major sap-sucking pest, leading to the increasing adoption of biopesticides as a sustainable alternative to chemical control. However, existing research has largely focused on the final lethal effects of these agents, while their short-term interference patterns on pest feeding behavior remain unclear. In this study, six biopesticides-azadirachtin, matrine, *Beauveria bassiana*, *Metarhizium anisopliae* CQMa421, *Mamestra brassicae* nucleopolyhedrovirus (MbNPV), and *Bacillus thuringiensis* (Bt)-were evaluated using the electrical penetration graph (EPG) technique to precisely analyze their interference on the short-term (6 h) feeding behavior of *E. onukii*, alongside field trials to validate control efficacy. EPG analysis revealed that different types of biopesticides significantly disrupted feeding in distinct ways. The two botanical

pesticides and CQMa421 mainly prolonged the non-probing phase (waveform Np) and reduced active non-phloem feeding (C waveform) ($p < 0.05$); Bt and *B. bassiana* significantly extended the resting phase (waveform R) and decreased the frequency of passive phloem feeding (waveform E) ($p < 0.05$), whereas MbNPV exhibited a combined effect, simultaneously prolonging both Np and R waveforms while reducing waveform C ($p < 0.05$). Field trials showed that all tested treatments achieved complete control (100%) at 21 days post-application. Moreover, across a wide range of concentrations, they all demonstrated excellent and stable control performance. These findings provide diverse agent options for the green control of *E. onukii* in tea plantations and lay a foundation for constructing a green integrated pest management system centered on biological control for tea plant pests.

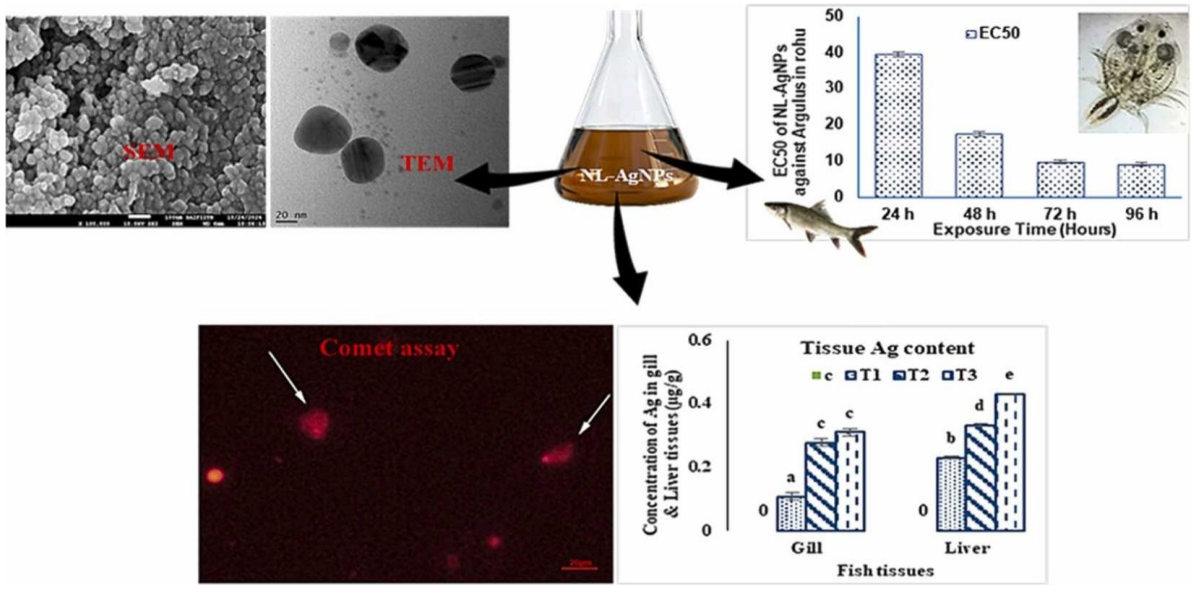
Neem in Aquaculture

Antiparasitic efficacy and safety evaluation of green-synthesized silver nanoparticles as sustainable nanotherapeutics against Argulus siamensis in Labeo rohita.

Kumari P, Kumar S, Brahmchari RK, Rajendran KV, Shukla SP, Sharma R, Bedekar M, Raman RP.Vet Parasitol. 2026 Mar 5;344:110742. doi: 10.1016/j.vetpar.2026.110742. Online ahead of print.PMID: 41807899

Argulosis poses a major challenge to freshwater aquaculture, and the use of conventional chemotherapeutics is increasingly constrained by environmental and sustainability concerns. In this study, silver nanoparticles were synthesized using Azadirachta indica (neem) leaf extract and evaluated for their antiparasitic efficacy (AE) against Argulus siamensis infesting Labeo rohita. Neem leaf-synthesized silver nanoparticles (NL-AgNPs) showed a characteristic surface plasmon resonance peak (λ_max) at 420 nm and a zeta potential of -28 mV, indicating good stability. The nanoparticles were spherical in shape with an average size of 20 ± 5 nm. FTIR analysis confirmed the presence of functional groups responsible for nanoparticle reduction and stabilization. An acute toxicity test of NL-AgNPs in L. rohita revealed a 96-h LC_{50} of 28.25 mg L^{-1} , with no observed mortality in the control group. The in vivo exposure to NL-AgNPs resulted in concentration-dependent AE of 36, 75, and 100% at 7.05, 14.12, and 21.19 mg L^{-1} , respectively, with a 96-h EC_{50} of 9.12 mg L^{-1} and a therapeutic index of 3.10. Environmental scanning electron microscopy showed dose-dependent nanoparticle deposition on the parasite surface, causing severe structural damage and resulting in parasitic death. ICP-OES analysis following 14 days of exposure showed significantly higher silver accumulation in the liver (0.430 µg g^{-1}) than in the gills (0.31 µg g^{-1}), following a dose-dependent trend. Further, the comet assay demonstrated a concentration-dependent increase in DNA damage with % DNA in tail values of 15.49% (tail length: 6.35 px) and 7.27% (tail length: 4.63 px) at 21.19 and 14.12 mg L^{-1} , respectively. Histopathological analysis further revealed substantial restoration of Argulus -induced tissue damage in the gills, liver, muscle, and kidney of L. rohita following NL-AgNP treatment. Overall, green-synthesized AgNPs demonstrate promising antiparasitic effects against Argulus siamensis, with mild toxic responses observed in Labeo rohita under the tested conditions. However, further investigations

addressing chronic exposure, bioaccumulation, and depuration dynamics are necessary to evaluate the long-term safety and sustainability of NL-AgNPs applications in aquaculture.



Neem in Food Preservation

Sustainable ethyl cellulose fibrous films with nitrogen-carbon dots for fresh-cut apple preservation.

Pillai BP, Priyadarshi R, Tyagi A.Int J Biol Macromol. 2026 Apr;353:151195. doi: 10.1016/j.ijbiomac.2026.151195. Epub 2026 Mar 4.PMID: 41791539

Sustainable active packaging films are increasingly being explored as practical tools for prolonging the freshness of sliced fruits. This study reports the fabrication of ethyl cellulose/poly(ethylene oxide) fibrous films incorporated with nitrogen-carbon dots (NCDs) using a simple electrospinning technique for active food packaging applications. The NCDs were prepared via a one-pot hydrothermal method using neem leaves as the precursor. As confirmed by HR-TEM, the synthesized NCDs had a quasi-spherical shape with a diameter of ~1.6 to 3.4 nm. In addition, the NCDs incorporated fibrous films exhibited excellent water stability, hydrophobicity, and mechanical properties. The fibrous films were examined to determine the UV-Vis resistance and free radical scavenging activity via DPPH and ABTS assays. At the higher concentrations of NCDs in the fibrous films, UV blocking of 99.9% against both UV-A and UV-B radiations was achieved, indicating their excellent UV resistance. Also, the DPPH and ABTS free radical scavenging rates remarkably raised to ~73% and ~90%, respectively. The visual decay and browning of fresh-cut apples packed in the fibrous films were reduced during the 5-day storage study. In conclusion, NCDs incorporated films could be utilized for an active, sustainable packaging material with enhanced UV resistance and antioxidant characteristics for preserving fresh-cut fruits.

Neem for Human Health

Antimicrobial and antibiofilm activities of **neem** and myrrh extracts against Enterococcus faecalis in dentin specimens.

Rifaat S, Abuohashish HM, Alsaleh R, Alqahtani M, Aloraifi N, Aljarbaua J, Albeladi A, Almajed Y, Alharamlah F, Aleraky D.Dent Med Probl. 2026 Mar 18. doi: 10.17219/dmp/197325. Online ahead of print.PMID: 41849270

Background: Enterococcus faecalis is a primary oral pathogen responsible for root canal treatment failures. The clinical use of conventional root canal disinfectants may be associated with cytotoxicity and other unfavorable effects.
Objectives: The aim of the study was to assess and compare the antimicrobial effect of Azadirachta indica (neem) and Commiphora molmol (myrrh) extracts against E. faecalis biofilm in dentin samples.
Material and methods: The minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) of neem and myrrh extracts against E. faecalis (ATCC 29212) were determined. Human dentin discs were prepared and inoculated with E. faecalis for 21 days. The antibiofilm activities of neem and myrrh extracts were compared using colony forming unit (CFU) assays, cell proliferation assays and live/dead fluorescence microscopy. A 5.25% sodium hypochlorite (NaOCl) solution and 2% chlorhexidine (CHX) were used as standard disinfectants.
Results: The MIC values for the neem and myrrh extracts were 0.0312 mg/mL and 0.0156 mg/mL, respectively, while the MBC values were 0.0625 mg/mL and 0.0312 mg/mL, respectively. The CFU assay revealed a significant decrease in bacterial counts in the neem and myrrh groups. Similarly, cell counting kit-8 (CCK-8) assays demonstrated decreased bacterial viability in the neem and myrrh groups compared with the phosphate-buffered saline (PBS) group. Furthermore, live/dead fluorescence microscopy confirmed the antibacterial effects of both extracts against E. faecalis.
Conclusions: Myrrh and neem extracts showed promising antimicrobial potential as root canal disinfectants. These natural agents may serve as effective alternatives to conventional chemical endodontic irrigants.

Herbal Extracts for Denture Care: Effectiveness and Safety Through *In vivo* Studies-A Systematic Review.

Balaraman G, Bharanija KS, Prasanna JG, Badimela A, Subramoniam C, Fiona J.J Pharm Bioallied Sci. 2025 Dec;17(Suppl 5):S3477-S3479. doi: 10.4103/jpbs.jpbs_1263_25. Epub 2025 Nov 12.PMID: 41846739

The increasing demand for removable dentures among the geriatric population underscores the need for safe and effective denture cleansers and adhesives. Concerns over the toxicity, cost, and limited biocompatibility of conventional chemical-based products have led to increasing interest in herbal alternatives. This systematic review assessed the efficacy and safety of herbal extracts in denture care. A comprehensive search of PubMed, ScienceDirect, Wiley Online Library, and the Cochrane Library was

conducted using the terms "herbal denture cleansers," "herbal denture adhesives," and "denture care." In vivo studies published in English since 2010 were included, and seven studies met the inclusion criteria. Herbal agents such as Neem, Triphala, Aloe vera, turmeric, and olive oil demonstrated significant antifungal and antimicrobial activity, comparable to commercial formulations, along with improved denture retention and mucosal health. Overall, herbal extracts hold promise as effective, safe, and biocompatible alternatives for denture maintenance and patient comfort.

Ethnopharmacological considerations of plants traditionally used by local communities to manage maternal conditions in Tanzania: a scoping review.

Omary M, Nguyamu M, Nkoma J, Japhari HS, Bishoge OK, Peter EL.Front Pharmacol. 2026 Feb 17;16:1713947. doi: 10.3389/fphar.2025.1713947. eCollection 2025.PMID: 41783344

Ethnopharmacological relevance: Despite notable progress in maternal health and a reduction in maternal mortality rates, Tanzania still falls short of global targets. Local women increasingly use herbal medicine to manage maternal conditions, highlighting the need of documenting and evaluate these traditional practices.
Aim of the study: In this study, we aimed to identify the medicinal plants commonly used by women to manage maternal conditions and to critically evaluate the available scientific evidence regarding their efficacy and safety.
Methods: A scoping review was conducted in accordance with the framework of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for scoping reviews (PRISMA-ScR). Articles were retrieved from PubMed, Web of Science, Scopus, African Index Medicus (AIM), Maternity and Infant Care (MIC), and CINAHL, covering the period from inception to July 2025. Eligible studies were screened for relevance and taxonomic accuracy. Data were analyzed using descriptive statistics (frequency distribution and percentages) in Microsoft Excel.
Results: A total of 330 plant species from 82 families were identified across 14 regions. Morogoro, Pwani, and Kagera exhibited the highest species diversity. The most represented families were as follows: Fabaceae (57 species), Rubiaceae (22 species), and Asteraceae (18 species). Frequently cited plants included *Azadirachta indica* A. Juss. (five citations), *Annona senegalensis* Pers., (four citations), and *Ricinus communis* L. (four citations). Twelve maternal conditions were reported to be managed using at least one of these plant species. However, only 23 species (7%) had scientific evidence supporting their traditional use, and only 74 species (22%) had safety data confirming non-toxicity.
Conclusion: Tanzanian women utilize a wide range of medicinal plants to manage maternal conditions; however, only a small proportion of these plants have been scientifically validated or have safety data. Further pharmacological and toxicological studies are needed to verify their efficacy and ensure maternal safety. Healthcare providers should remain aware of potential concurrent herbal use during clinical encounters to ensure optimal patient care.

Phytochemical Assessment, Evaluation of Antioxidant and Antibacterial Properties, and Molecular Docking to Elucidate the Regulation of Bacterial Biofilm Formation in an Herbal Formulation for the Treatment of Abscesses.

Tadtong S, Techavijit S, Mukdapattanakul N, Singh S, Chittasupho C, Eiamart W, Samee W.Int J Mol Sci. 2026 Feb 25;27(5):2145. doi: 10.3390/ijms27052145.PMID: 41828371

Abscess formation is commonly precipitated by bacterial infection. This study delineates the phytochemical composition and evaluates the antioxidant, antibacterial, and anti-biofilm activities of a Thai traditional anti-abscess herbal formulation comprising *Curcuma zedoaria*, *Vitex trifolia*, and *Azadirachta indica*. Validated high-performance liquid chromatography-photodiode array detection (HPLC-PDA) analysis of the ethanolic extract identified curcumin, demethoxycurcumin, bisdemethoxycurcumin, and vitexicarpin as principal constituents. Total phenolic and flavonoid contents were 32.08 ± 2.54 mg GAE/g and 17.52 ± 1.28 mg QE/g dry weight, respectively. Antioxidant assessment by 2,2-diphenyl-1-picrylhydrazyl (DPPH) assay yielded an half maximal inhibitory concentration (IC_{50}) of 53.46 ± 3.24 µg/mL, while reducing power corresponded to 383.97 ± 13.24 µg FeSO4/g dry weight. Molecular orbital analysis revealed a highest occupied molecular orbital and lowest unoccupied molecular orbital (HOMO-LUMO) gap for vitexicarpin (ΔE = 9.7710 eV), indicative of greater radical-scavenging potential relative to curcuminoids. Antibacterial assays demonstrated selective activity against *Staphylococcus epidermidis* (inhibition zone 1.48 ± 0.16 cm), with no observed inhibition of *Staphylococcus aureus* or *Streptococcus pyogenes*. Curcumin exhibited the highest activity against *S. epidermidis* (minimum inhibitory concentration (MIC) 62.5 µg/mL; minimal bactericidal concentration minimal bactericidal concentration (MBC) 125 µg/mL). Molecular docking showed curcumin binding to the teicoplanin-associated transcriptional regulator (TcaR) with a binding energy of -8.00 kcal/mol, comparable to methicillin (-8.16 kcal/mol), suggesting a potential mechanism for modulation of biofilm-associated regulatory pathways. Collectively, these findings indicate that the formulation has measurable antioxidant activity and targeted antibacterial efficacy against *S. epidermidis*, which may contribute to attenuation of abscess progression via interference with biofilm regulation.

Evaluating the antiviral efficacy of Azadirachta indica and Moringa oleifera against hepatitis B and C: Implications for alternative therapeutic approaches.

Arshad A, Adeeb R, Jabeen N, Anwaar S, Zaheer Hussain S, Anwar T, Qureshi H, M Al-Khayri J, Al-Dossary O, Alsubaie B, I Aldaej M, Fathi Shehata W, I Almaghasla M, Q Al-Mssallem M.Pak J Pharm Sci. 2026 May;39(5):1284-1294. doi: 10.36721/PJPS.2026.39.5.REG.14109.1.PMID: 41879388

Background: Chronic hepatitis B (HBV) and C (HCV) remain major global health burdens due to high morbidity, treatment costs, and the emergence of antiviral resistance. Plant-derived compounds offer a potential alternative or complementary therapeutic approach. This study evaluated the antiviral effects of Azadirachta indica (neem) and Moringa oleifera (drumstick tree) leaf extracts on peripheral blood mononuclear cells (PBMCs) obtained from HBV- and HCV-infected patients.

Objectives: To determine and compare the phytochemical profiles of A. indica and M. oleifera leaf extracts and assess their antiviral activity through induction of apoptosis and necrosis in virus-infected PBMCs.
Methods: Leaf extracts were subjected to phytochemical screening. PBMCs isolated from HBV- and HCV-infected patients were treated with each extract and analyzed by flow cytometry to quantify live, apoptotic, and necrotic cell populations. Statistical analysis was performed using one-way ANOVA with significance set at $P < 0.05$.
Results: Phytochemical analysis revealed that A. indica contained flavonoids, alkaloids, tannins, saponins, glycosides, and steroids, whereas M. oleifera contained flavonoids, alkaloids, and tannins but lacked glycosides and saponins. In HBV-infected PBMCs, A. indica significantly reduced live cell percentages from 24.3% to 11.35% and increased necrotic cells from 18.98% to 55.43%. In HCV samples, live cells decreased from 40.27% to 37.78%, while necrosis increased from 21.35% to 30.1%. M. oleifera demonstrated comparatively moderate effects consistent with its simpler phytochemical profile.
Conclusion: A. indica exhibited strong antiviral potential, markedly enhancing necrotic responses in HBV- and HCV-infected PBMCs, while M. oleifera showed moderate activity. These results highlight the therapeutic promise of phytochemical-rich extracts, particularly A. indica. Further investigations-including in-vivo validation, dosage formulation, cost-effectiveness assessments, and evaluation of synergistic effects with existing antiviral therapies-are warranted to advance their development as complementary treatments for chronic viral hepatitis.

Host and Parasite-Targeted Mechanisms of **Gedunin** Against Cutaneous Leishmaniasis: In Vitro and In Vivo Evaluation.
Alanazi AD, Alasmari SM.Acta Parasitol. 2026 Mar 10;71(2):62. doi: 10.1007/s11686-026-01240-1.PMID: 41806047

Background: The main pharmacological interventions for cutaneous leishmaniasis (CL) are associated with various adverse effects. The present study aims to comprehensively evaluate the antileishmanial impact of gedunin (GN) and its effects on the expression of immune and virulence-related genes.
Methods: The antileishmanial efficacy and synergistic effects of GN, both as a monotherapy and in combination with glucantime (GT), were evaluated against the intracellular amastigote stages of *Leishmania tropica*. Additionally, the impact of GN on the expression of genes related to immunomodulation and virulence factors, nitric oxide (NO) and reactive oxygen species (ROS) production, and its cytotoxicity on human monocytic THP-1 cells were assessed. In addition, the expression levels of inducible nitric oxide synthase (iNOS), interferon gamma (IFN-γ), and tumor necrosis factor (TNF-α), NF-κB p65, IL-12, and IL-10 were evaluated in the Leishmania-infected macrophages. In vivo evaluation of GN, GT, and GN + GT was also performed in mice with CL through evaluating lesion size and parasite burden.
Results: Investigations involving infected macrophages demonstrated that treatment with GN led to a progressive, concentration-dependent decline in the viability of intracellular amastigotes. the IC_{50} values for GN, GT, and the combined GN + GT formulation were 8.63, 7.42, and 3.30 µg/mL, respectively. The FICI values determined for GN and GT were

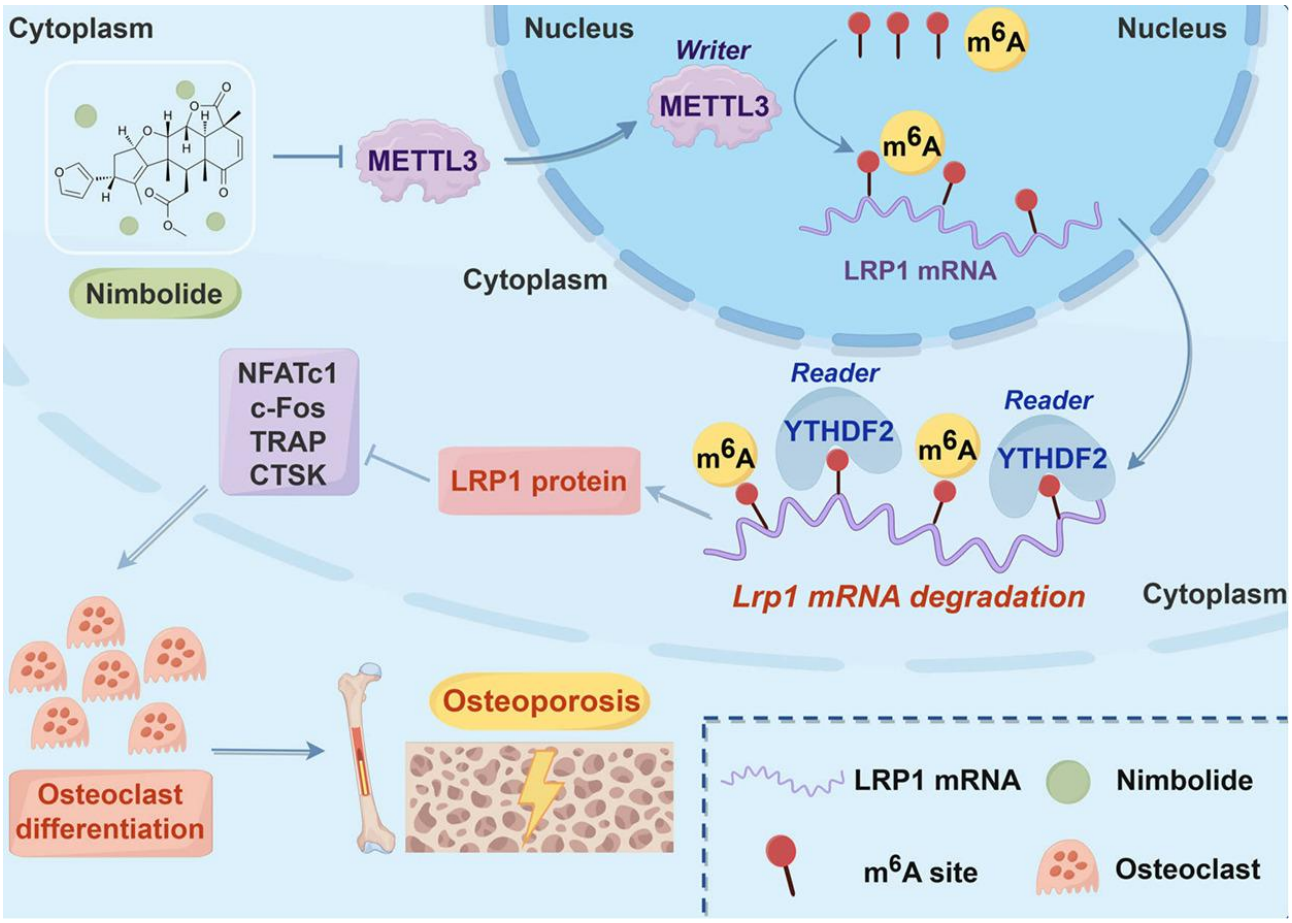
0.31 and 0.49, respectively; indicated the existence of synergistic interactions when GN is combined with GT. The treatment with GN at both IC_{50} and half-IC_{50} concentrations, particularly when combined with GT at half-IC_{50}, resulted in a significant downregulation of the *GP63, MPI*, *Arg*, and *CP* gene expression levels compared to treatment with GT alone ($P < 0.001$). The combination of GN at IC_{50} with GT at IC_{50} showed the highest elevation ($P < 0.001$) in the expression level of iNOs, TNF-α, and IL-12; whereas, markedly increased the level of NF-κB p65 and ROS generation ($P < 0.001$). In addition, we found that after 28 days of treatment, the cohort administered the GR + GT combination exhibited complete recovery (100%). Furthermore, the parasite load at the treated wound site was markedly diminished, with the most pronounced reduction observed in the GR + GT combination group ($P < 0.001$).

Conclusion: The current study demonstrated that GN, especially in combination with GT, showed the potential in vitro and in vivo antileishmanial effects and reducing *Leishmania* virulence genes and enhancing host immune response. Future studies can elucidate the detailed molecular mechanisms, long-term effects, and possible clinical applications of GN in clinical models. These data form the basis for designing novel and targeted antileishmanial therapeutic strategies.

A novel METTL3 inhibitor **nimbolide** ameliorates osteoporosis via orchestrating osteoclastogenesis in an m6A-dependent manner.

Cai C, Zhang Z, Zhao X, Yang C, Huang X, Tang C, Qiu H, Yang S, Zhang Y, Hu X, Zuo R, Zhang C, Chen Y, Chu T.Phytomedicine. 2026 Mar 7;155:158048. doi: 10.1016/j.phymed.2026.158048. Online ahead of print.PMID: 41865687

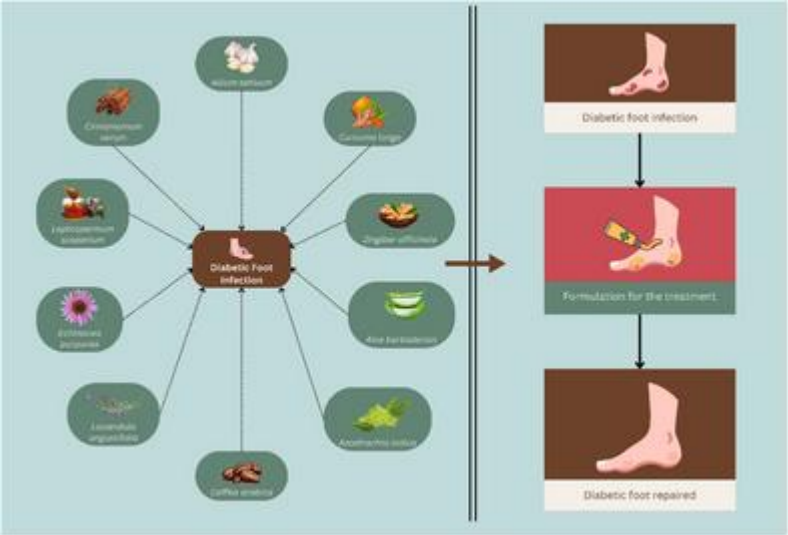
Osteoporosis (OP) is a prevalent chronic metabolic bone disease linked to estrogen deficiency and lacks effective therapies with minimal side effects. While N6-methyladenosine (m^6A) methylation plays a crucial role in OP progression, its critical effect on osteoclastogenesis during OP remains unclear. In this study, we demonstrate that METTL3 promotes osteoclast differentiation and bone erosion in OP, and its expression positively correlated with bone loss. METTL3 silencing abolished osteoclast formation, while its overexpression exacerbated bone resorption. Through molecular docking, dynamics simulation, cellular thermal shift assay and surface plasmon resonance assay, we identify the natural compound Nimbolide (Nim) as a direct METTL3 inhibitor that disrupts its methyltransferase activity. Nim treatment suppressed RANKL-induced osteoclastogenesis and attenuated ovariectomy-induced OP in mice. Mechanistically, multi-omics integration (RNA-seq/MeRIP-seq/RIP-seq) combined with in vitro molecular validation revealed that METTL3 installs m^6A on Lrp1 mRNA, recruiting the reader YTHDF2 to degrade transcripts and decrease the anti-osteoclastogenic protein LRP1. Nim restored LRP1 by blocking METTL3-mediated m^6A methylation, thereby inhibiting osteoclast hyperactivity. Critically, AAV9-driven METTL3 overexpression reversed Nim's efficacy in OVX mice. Our work identifies Nim as a novel METTL3 inhibitor that protects against OP via the METTL3-m^6A-YTHDF2-LRP1 axis, providing novel insights into targeting METTL3-dependent m6A signaling as a promising therapeutic strategy for OP.



Nano-Enabled Herbal Therapeutics for Diabetic Foot Ulcers: Translating Ethnopharmacological Bioactives into Advanced Wound Care.

Mishra MK, Akram W, Sharma S, Pamu S.Chem Biodivers. 2026 Mar;23(3):e03644. doi: 10.1002/cbdv.202503644.PMID: 41823036

Diabetic foot ulcer (DFU) is a common and serious complication in individuals with diabetes, representing a leading cause of hospitalization and frequently resulting in severe outcomes such as amputations, increased morbidity, and mortality. The development of diabetic foot infection (DFI) is typically attributed to a combination of factors, including persistent hyperglycemia, impaired immune function, peripheral neuropathy, and vascular insufficiency. Early diagnosis and prompt treatment are crucial for favorable outcomes; however, the growing prevalence of antibiotic-resistant pathogens presents a significant challenge, placing additional strain on healthcare systems. Considering these concerns, there is an increasing interest in herbal therapies with antimicrobial, anti-inflammatory, and wound-healing properties-such as garlic (Allium sativum), turmeric (Curcuma longa), and neem (Azadirachta indica)-as potential adjunct or alternative treatments. This review explores key aspects of DFI, including its pathophysiology, global prevalence, statistical data, risk factors, diagnostic approaches, current and potential herbal treatments, associated challenges, and future directions.



Diabetes mellitus in ECOWAS: an overview of the safety and efficacy of medicinal plants used in traditional medicine practices.

Ohouko OFH, Lègba BB, Agbodjento E, Akanmu AO, Balogun ST, Mante PK, Mendes J, Sodipo OA, Dougnon V, Klotoé JR.Trop Med Health. 2026 Mar 23;54(1):56. doi: 10.1186/s41182-026-00936-4.PMID: 41872917

Background: The rich biodiversity of West Africa supports a vast repository of medicinal plants, with traditional medicine playing a central role in managing diseases such as diabetes. Despite their widespread use, the safety and efficacy of these herbal treatments have not been scientifically explored. This study aims to analyze the traditional uses of antidiabetic plants in Economic Community of West African States countries in relation to the available scientific evidence. **Methods:** A three-step approach was used. Firstly, ethnopharmacological studies on diabetes management in West Africa were identified. Secondly, the twelve most cited plants were selected on the basis of their frequency of citation of traditional antidiabetic uses, and their citation in at least five of the countries considered. Thirdly, scientific databases were searched for available in vitro, in vivo, and clinical studies examining the antidiabetic effects, antioxidant properties, and potential toxicity of the twelve plants selected.

Results: This study identified 638 medicinal plants from 32 ethnopharmacological studies conducted in eight West African countries. The twelve most cited plants were Mangifera indica, Rauvolfia vomitoria, Azadirachta indica, Morinda lucida, Launea taraxacifolia, Momordica charantia, Phyllanthus amarus, Vernonia amygdalina, Carica papaya, Annona senegalensis, Allium sativum and Ocimum gratissimum. Most remedies were prepared from leaves, roots, and bark, commonly as decoctions or macerations, and demonstrated notable hypoglycemic activity. However, the mechanism of action behind the antidiabetic activity of these plants has rarely been addressed, and few of these plants have undergone clinical trials and in-depth toxicological evaluations.

Conclusion: This review highlights a significant gap between traditional knowledge and scientific assessment. Although these traditional medicinal plants show promise for diabetes management, further scientific validation is needed to ensure their safe and effective use in modern healthcare systems.

Anti-Breast Cancer Effects of Carbon Quantum Dots: In Vivo Angiogenesis and Arginase Co-Inhibition.

Singh G, Maity S, Yadav DD, Das T, Wasnik K, Pradhan R, Kudada AS, Pareek D, Patra S, Mourya A, Panda S, Batra T, Paik P.ACS Appl Bio Mater. 2026 Mar 17. doi: 10.1021/acsabm.5c02284. Online ahead of print.PMID: 41841461

Breast cancer evades the immune system through immune-regulating enzymes. One of them is arginase, primarily produced in tumor-resident cells, especially by tumor-associated macrophages and myeloid-derived suppressor cells. This helps malignant tumors thrive and escape immune surveillance. However, targeting arginase is challenging because of its crucial role in the urea cycle. Pharmacological inhibitors of arginases have been linked to severe side effects in nitrogen metabolism, particularly hyperammonemia. Herein, therefore, we report on the arginase-inhibition-based in vitro and in vivo treatment of BC-bearing mice with carbon quantum dots (CQDs) derived from Azadirachta indica. These CQDs inhibit the arginase enzyme, thereby exhibiting anti-angiogenic and anti-proliferative properties. These CQDs contribute to 68 ± 5% remission of malignant tumors and 58 ± 5% inhibition of cell growth through arginase inhibition. This is particularly difficult to achieve with contemporary anti-cancer drugs. Protein upregulation of IFN-γ, IL-6, IL-8, IL-21, TLR4, LAT-1, T-cell marker, and IgG and downregulation of TNFα and IL-1β corroborate an increase in the anti-tumor immune response. Furthermore, histological results show an increase in the inhibition of cancer cells and an increase in immune cells after CQD treatment. Overall, the CQDs reported herein are paramount for the treatment of aggressive BC, which can further be used for the treatment of other cancers. The results further demonstrate that these CQDs can potentially be delivered to terminally ill patients who are not responding to contemporary therapies.

Epoxyazadiradione, a **neem**-derived limonoid exhibits activities against pancreatic cancer through modulation of inflammatory molecules, lncRNAs, ROS, and EMT.

Rai V, Srivastava A, Shekher A, Dutta A, Gupta SC.Biochim Biophys Acta Gen Subj. 2026 Mar 23:130938. doi: 10.1016/j.bbagen.2026.130938. Online ahead of print.PMID: 41881140

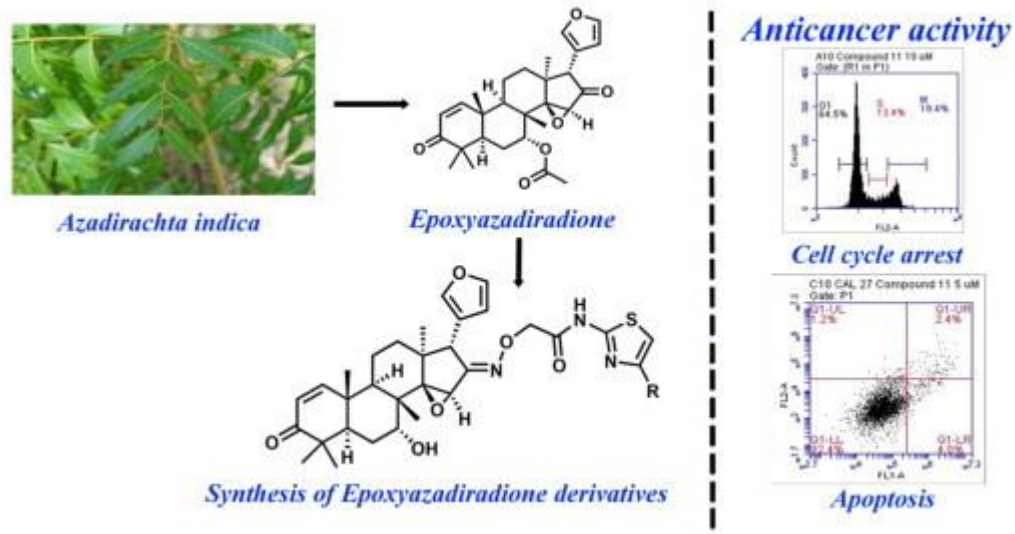
Pancreatic cancer is the seventh most prevalent cancer worldwide, with persistently low life expectancy that hasn't changed for many decades. Agents derived from Mother Nature has been emphasised for drug development due to their safety, affordability, and ability to modulate multiple cell signalling pathways. Among such agents, azadiradione (AZA) and epoxyazadiradione (EPA) are two limonoids derived from the neem plant (Azadirachta indica). Both of these limonoids are reported to exhibit cytotoxic activities against some cancer types. However, the potential of EPA and AZA against pancreatic cancer and the underlying mechanism has not been reported earlier. In this study, we investigated the potential of EPA and AZA against pancreatic cancer cells. Our results demonstrated that EPA possess greater cytotoxic potency against pancreatic cancer compared to AZA while non-malignant epithelial cells were only minimally affected by the limonoid. Further, EPA triggered apoptosis in pancreatic cancer cells as revealed by morphological changes, DNA

fragmentation, cell cycle arrest, and annexin-V staining. EPA also induced ROS generation and altered the mitochondrial membrane potential. EPA inhibited the translocation of NF-κB-p65 and downregulated the expression of proteins related to cell survival (Bcl-xL, Bcl-2, survivin) and invasion (MMP-9), while inducing the proapoptotic protein (Bax). The expression of lncRNAs was modulated, and the gene silencing of GAS5 reversed the effects of EPA in pancreatic cancer lines. It also enhanced the sensitivity of cell lines to paclitaxel, decreased the spheroid formation and modulated the expressions of EMT markers. These cumulative findings revealed that EPA exhibits anti-cancer activity against pancreatic cancer.

Synthesis of **epoxyazadiradione**-thiazole hybrid derivatives and evaluation of their cytotoxic activities.

Kumari GS, Andugulapati SB, Ramalingam V, Suresh Babu K.Nat Prod Res. 2026 Apr;40(7):1684-1689. doi: 10.1080/14786419.2024.2429130. Epub 2024 Nov 18.PMID: 39555584

In an attempt to develop natural product-based anticancer agents, a series of novel epoxyazadiradione-thiazole hybrids (**6a-j**) were synthesised and evaluated for their anticancer activity. All the synthesised derivatives were assessed for *in vitro* cytotoxic activity against a panel of human cancer and normal cell lines and the results showed that most of the compounds exhibited significant cytotoxic activity against cancer cells and as well some of the compounds showed less cytotoxicity against normal cells. In particular, compound **4** showed potent cytotoxic activity against tongue cancer cell lines. In consideration of the potent activity, the compound **4** was further assessed for cell cycle



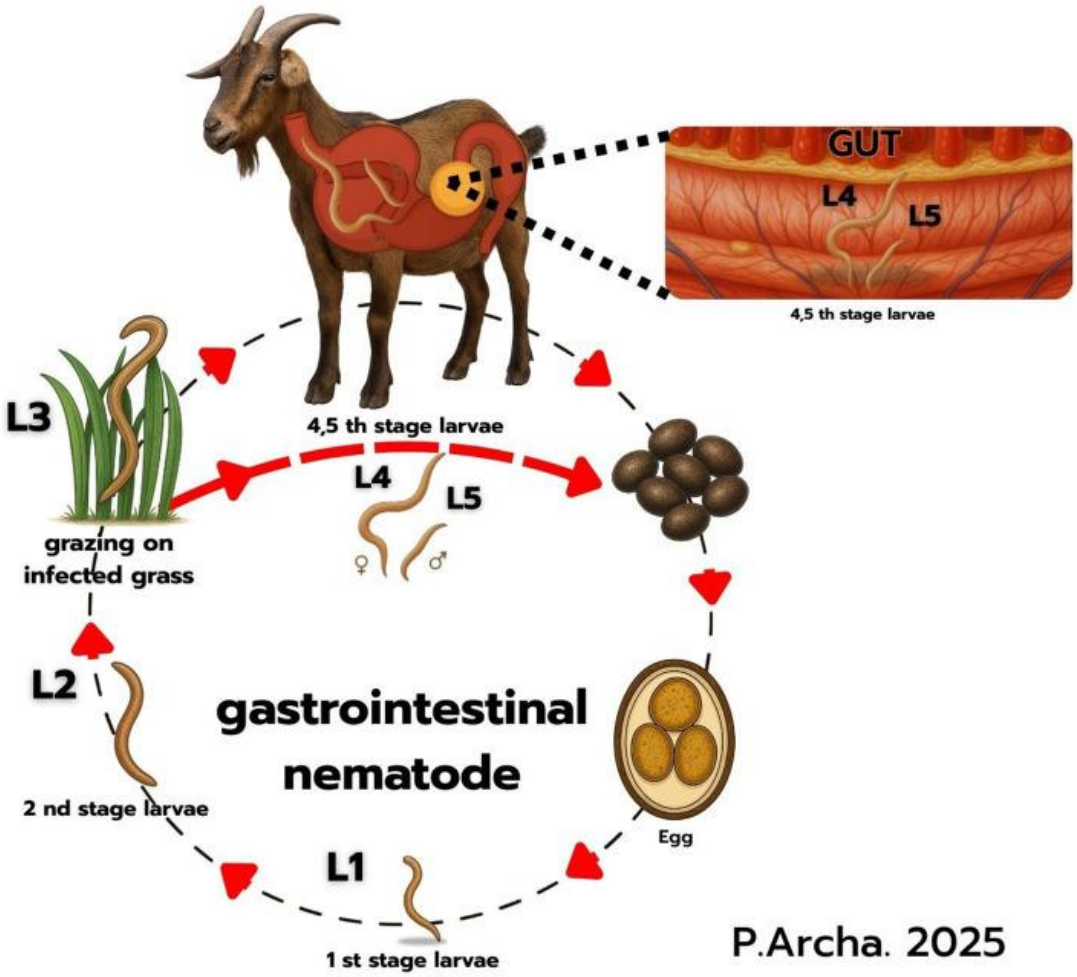
analysis and the results showed that the compound arrests the cell cycle progression at the G0/G1 phase in the tongue cancer cell lines. Consequently, the annexin V/PI staining assay demonstrated that compound **4** induced early apoptosis against tongue cancer. Taken together, the results inferred that the epoxyazadiradione is promising anticancer candidate for developing novel anticancer drugs against tongue cancer.

Neem in Veterinary Science

Impact of dietary purple **neem** (Azadirachta indica) leaves on growth, ability to neutralize free radicals and helminth control in meat goats.

Archa P, Sota P, Paengkoum P.Front Vet Sci. 2026 Mar 5;13:1769618. doi: 10.3389/fvets.2026.1769618. eCollection 2026.PMID: 41868405

This study examined the effects of purple neem (PN) leaf supplementation in concentrate diets on growth performance, feed intake (FI), nutrient digestibility, antioxidant activity, and fecal parasite egg counts in crossbred male goats. Fifteen Chami × Anglo Nubian goats (20.43 ± 5.5 kg; aged 1-2 years) were randomly assigned to three treatments: 0, 3, and 6% PN leaf supplementation (DM basis). Goats were fed ad libitum with corn silage and concentrate diets containing 14% crude protein. PN supplementation significantly ($p < 0.05$) increased final body weight, weight gain, and dry matter (DM) intake, with the highest body weight at 6% inclusion. Digestibility of DM, crude protein (CP), and neutral detergent fiber (NDF) improved at 3 and 6% supplementation. Antioxidant activities (ABTS, DPPH, and SOD) were significantly enhanced, indicating improved antioxidant defense. Moreover, fecal strongyle egg counts decreased significantly in a dose-dependent manner, with the greatest reduction observed between days 28 and 56 at 3-6%. Overall, PN leaves demonstrate strong potential as a natural feed additive for improving health and productivity in goats.



Efficacy of **neem** oil (Azadirachta indica) as an antiparasitic treatment for scorpions (Androctonus bicolor) and its impact on venom production.

Planas J, Moraleda-Berral P, Checa R, Mundanatt V, Zahra F, Salah M, Bande B, Sonavane M, Siyam M.Vet Parasitol. 2026 Mar 12;344:110748. doi: 10.1016/j.vetpar.2026.110748. Online ahead of print.PMID: 41903410

Mite infestations are a recurrent welfare issue that significantly affect the health, venom production, and survival of scorpions, particularly under human care. Chemical acaricides such as permethrins and fipronil, widely used in veterinary medicine for mite and tick control, are contraindicated in scorpions. Since mites and scorpions both belong to the class Arachnida, even minimal exposure can result in severe toxicity or death. Neem oil (Azadirachta indica) has been widely recognized for its acaricidal, antibacterial, and antifungal properties. Its main compound, azadirachtin, interferes with mite development and reproduction, leading to reduced infestations and egg viability. This study evaluated the efficacy and safety of a 1% neem oil spray for controlling Pimeliaphilus spp. mites in forty adult Androctonus bicolor (A. bicolor) maintained for venom production. Neem oil was applied every 72 h for five sessions. Mite counts, egg viability, clinical tolerance, and venom productivity were assessed. Mite loads decreased progressively, reaching complete elimination by the fifth treatment, with no new mites detected during the subsequent 60 days. No mortality, irritation, or cuticular lesions were observed. Post-treatment venom extraction at six weeks, based on pooled venom, showed increases of 10% in liquid volume, 50% in dry mass, and 36.5% in protein concentration compared with pre-treatment values. These results demonstrate that 1% neem oil provides an effective, safe, sustainable and low-cost acaricidal option for scorpions under human care, with benefits for venom yield and animal welfare.