Review Article

PHARMACOLOGICAL ACTIVITY REVIEW ON SELECTED INDIAN TRADITIONAL MEDICINAL PLANTS

ABSTRACT

The medicinal plants are the rich source of therapeutic phytoconstituents. The wide range of plants possesses vast range of medicinal uses in humanity. In the present study a review was conducted for selected plants for the medicinal activity they possess which are scientifically published in reputed journals. The activityresearched is antioxidant, anti-inflammatory, antibacterial, antiulcer, hepatoprotective and anticancer activity etc. The present review shown that Pongamia pinnata, Nerium oleander methanol extract and Andrographis paniculata, Macaranga peltata alcoholic extracts possess wide range of therapeutic activities.

Key words: Antibacterial, Antifungal, Pongamia pinnata, Nerium oleander, Andrographis paniculata, Macaranga peltata

INTRODUCTION

Medicinal plants are used for curing innumerable diseases. In terms of medicinal uses mixture of constituents found in extracts of plants are more effective than isolated compounds. Many herbs in nature possess tissue regenerating property as they possess pharmacologically active compound in minute quantity along with energy boosting molecules such as carbohydrates, lipids and proteins.

The plants possess various therapeutic activities which should be brought to the notice of the scientific field for the systematic evaluation. Hence an attempt was made to review the select plants to know the possessing therapeutic activity. The plants selected are Pongamia pinnata, Nerium oleander, Andrographis paniculata and Mecaranga peltata

Pongamia pinnata

Singh RK et al. [1] reported, the anti-inflammatory activity of seed extracts of *Pongamia pinnata* in rat using carrageenan, bradykinin, PGE induced models and inflammation intensity measured by production of inflammatory molecules

histamine and 5-HT. The result indicates that all extracts of seed (ethanol, petroleum ether, chloroform and acetone) shown anti-inflammatory activity when administered intra-peritoneally. (i.p)

Kumar P et al. [2] reported, the *Pongamia pinnata* flower and flower buds were having antibacterial and antifungal activity. Flower extracts shown higher antibacterial activity against Staphylococcus aureus and .Klebsiella. pneumoniae as compared to pod extract. Flower extract shown higher antifungal activity than pod extract.

Comment [MGP1]: Why did the extract have the highest activity?

Raut RWet al. [3] reported, extracellular synthesis of silver nanoparticles using dried leaves of *Pongamia pinnata* (L) pierre. The method represents an example of clean, nontoxic and eco-friendly method for obtaining silver nanoparticles. The capping around each particle furnish uniform chemical environment formed by the bioorganic compound present in the leaf broth, which may be mainly responsible for the stabilization of the particles. The antibacterial effect of nanosized silver colloidal solution against Staphylococcus aureus (ATCC 6538), Klebsiella pneumoniae, Pseudomonas aeruginosa (ATCC9 027) and Escherichia coli (ATCC 8739) reveals high efficacy of silver nanoparticles as a strong antibacterial agent

Comment [MGP2]: Do any authors explain why nanoparticles are strong bacterial agents?

Sikarwar MSet al. [4] reported, antidiabetic activity of *Pongamia pinnata* leaf extracts in alloxan-induced diabetic rats. The *Pongamia pinnata* aqueous extract and ethanol extract showed potent antidiabetic effect in alloxan-induced diabetic rats and reduced the mortality rate significantly.

Rani MSet al. [5] reported, antibacterial activity of *Pongamia pinnata* on pathogens of clinical isolates. The seed extract of *Pongamia pinnata* with methanol and ethanol solvent at 100µg/ml concentration showed significant antibacterial activity on selected (Pseudomonas aeruginosa, Serratia marcescens, Proteus vulgaris, Micrococcusluteus, Klebsiella pneumonia, Staphylococcus aureus) in clinical isolates

Bhandirge SK et al. [6] reported,*Pongamia pinnata* bark ethanol extract having wound healing activity (excision and incision wound model). The study showed that 10% ethanolic extract ointment shown significant activity then 5% ointment, povidone iodine ointment used as standard.

Ratnam KV et al. [7] reported, that the *Pongamia pinnata* bark having anthelmintic & antiinflammatory activity. He performed anthelmintic activity in earth worms. The ethanol extract paralysed worms in 30min as compared to standard albendazole 26min and death time 35min & 30min respectively. The ethanol extracts 50mg/ml shown significant anti-inflammatory activity.

Kage DN et al. [8]reported,isolation of karajachromene from the seeds of *Pongamia pinnata*. Karajachromene at doses 25mg/kg & 50mg/kg shown 40.48% & 59.6% inhibition of paw oedema respectively as compared to standard diclofenac sodium (63.01%) at 10mg/kg body weight. He concluded that karajachromene exhibits anti-inflammatory reaction. The seed oil extracted using n-hexane for 20hr and after storage for 15days in cold condition the karajachromene crystals sedimented at the bottom test tubes. .

Dwivedi D et al. [9] reported, wound healing, anti-microbial and antioxidant potential of *Pongamia pinnata* in wistar rats. The results confirm that*Pongamia pinnata* having potent significant wound healing activity. The results confirmed by changes in wound contraction, increased tensile strength, increased hydroxyproline and hexosamine content, modulation of pro inflammatory and anti-inflammatory cytokine, moderate antimicrobial activity and in vivo antioxidant activity.

Shukla R et al. [10]reported, wound healing of ointment prepared by using *Pongamia glabra, Piper nigrum, Momordica charantia*. The study showed that *Momordica charatia*&*Pongamia glabra* which were administered orally and topically with *Piper nigrum* shown significant activity and in ointment

formulation can be used as market product and the effect can be enhanced by oral dose in anaemic burn wound model

Balasooriya Det al.[11] reported, wound healing potential of bark paste of *Pongamia pinnata* along with hirudotherapy: A single case study. The bark paste of *Pongamia pinnata* and paste of leaves of *Flueggea leucopyrus* was very effective and shown excellent healing effect in chronic and non-healing wound.

Nerium oleander

Kumar Set al. [12] reported, anti-inflammatory activity and antipyretic activity of *Nerium oleander* in wistar rats. The result shows that chloroform and alcoholic extract having significant anti-inflammatory activity and antipyretic activity, but petroleum ether & aqueous extract having less activity.

Comment [MGP3]: Why do petroleum ether and aqueous extracts have less activity?

Singhal KG et al.[13] reported, hepatoprotective and antioxidant activity of methanolic extract of flowers of *Nerium oleander* against CCl4–induced liver injury in rats. The result reflected the *'in vitro'* effectiveness of the extract in *'in vivo'* in terms of lipid peroxidation inhibitory capacity and further confirmed the significant hepatoprotective activity of the methanol extract of flowers of *Nerium oleander* L. along with its antioxidant mechanisms of action.

Benson KF et al.[14]reported, the antioxidant, anti-inflammatory, anti-apoptotic, and skin regenerative properties of an aloe vera-based extract of *Nerium oleander* leaves (NAE-8®). The result shows that NAE-8® extract has multiple beneficial effects to a cellular antioxidant protection system, and reduces cellular free radical production, both in the absence and in the presence of an inflammatory molecule

Akgun SG et al. **[15]reported,** wound healing activity of *Nerium oleander* in burn wound model. The study showed that burn wound can be analysed by inflammatory molecules (Malonaldehyde, Glutathione, Myeloperoxidase, TNF-alpha, IL-beta.) activity in all stages of inflammatory reaction. Silver

sulphadiazine used as standard. Author concluded that *Nerium oleander* having anti-inflammatory activity & reduced inflammatory molecules &decreased %DNA which is high in burn wound

Hase GJet al. [**16] reported,** phytochemical studies of*Nerium oleander* L. using GC-MS. The GCMS analysis of the solvent free extract of Nerium Oleander L. root having potent anticancer, anti-inflammatory, antimicrobial, 5-α-reductase inhibitor, nematicide, pesticide, analgesic, antioxidant activity due to presence of several phytoconstituents. Gas chromatography-mass spectrometry (GC-MS) analysis of *Nerium oleander* revealed the existence of the p-cresol, l-arginine, 2- methoxy phenol, mequinol, 2- methoxy phenyl ester, 2,4,6-decatrienoic acid etc. (58 compounds)

Ko YSet al. [17] reported, oleandrin and its derivative odoroside A, both cardiac glycosides exhibit anticancer effects by inhibiting invasion via suppressing the STAT-3 Signaling Pathway. The results suggest that oleandrin and odoroside A have anticancer effects by inhibiting invasion/metastasis in both MDA-MB-231 and RT-R-MDA-MB-231 cancer cells. The anticancer effects of oleandrin and odoroside A might be due to the suppression of phospho-STAT-3-mediated pathways that are involved in the regulation of invasion-related molecules, such as cancer stem cell markers and EMT-related proteins.

Kgosana KG[18]reported, the effects of extraction techniques and quantitative determination of oxalates in *Nerium oleander* as feed and other feeds. He concluded that aqueous extraction proved to be more valuable, safe, reliable and effective compared to the organic extraction methods.

Dey P et al.[19] reported, that oleander stem and root standardized extracts mitigate acute hyperglycaemia by limiting systemic oxidative stress response in diabetic mice. The oleander stem and root extract significantly lowers hyperglycaemia and insulin resistance without affecting insulin sensitivity.

Newman RA et al. [20] reported,antiviral effects of oleandrin. The findings are *Nerium oleander* having effective antiviral activity on enveloped viruses such as HIV-I, HTLV- I, influenza and venezuelan equine encephalitis. olenadrin active against HIV-I, HTLV- I, venezuelan equine encephalitis, chikungunya virus and SARS-CoV-2.

Andrographis paniculata

Mishra PK et al.[21] **reported,** the antibacterial activity of *Andrographis paniculata* leaves against clinical pathogens namely S.aureus, E.faecalis, P.aeruginosa, P.vulgaris and E.coli. The result showed that 75% methanol extract is having antibacterial principles in high percentage & active against methicillin resistant S.aureus, E.faecalis & M.tuberculosis also.

Deepak S et al.[22] reported,antioxidant & antimicrobial activity of *Andrographis paniculata* in DPPH radical scavenging assay & total reducing capacity. The leaf extracts shown considerable antioxidant & antimicrobial activity.

Pongtuluran OBet al. [23]reported, antiviral & immunostimulant activity of *Andrographis paniculata*. The study showed that *Andrographis paniculata* ethanol extract inhibited SRV(Simian Retro Virus) replication similar to positive control Lamivudine & having immunity enhancing property by stimulating lymphocyte cell proliferation at low concentration(1-16microgram) and extracted andrographolide was estimated by HPLC method.

Saini S et al.[24]reported, the traditional medicinal plants having wound healing activity along with anti-inflammatory, antioxidant, antimicrobial and analgesic activities. The study showed that petroleum ether & ethanolic extracts of *Andrographis paniculata* having effective wound healing activity and other supporting pharmacological activities.

Zou W et al.[25]reported, anti-inflammatory effect of *Andrographis paniculata* on pelvic inflammatory disease in rats through down regulation of the NF-kB pathway. In study oral administration showed significant anti-inflammatory activity in pathogen induced PID rats with a potential mechanism of inhibiting the NF-kB pathway. In US clinics PID is treated by antibiotics as recommended by CDC (centre for disease control) only.

Polash SA et al. [26] reported, Investigation of the phytochemicals, antioxidant, and antimicrobial activity of the *Andrographis paniculata* leaf and stem extracts. *A. paniculata* leaf and stem extracts were prepared using different solvents such as water and ethanol as the polar solvents and hexane as the nonpolar solvent. The ethanolic stem extract showed the highest total phenol content and the aqueous stem extract showed the maximum free radical scavenging activity.

Gan L et al.[27] reported, isolation of diterpenoid lactones with anti-inflammatory effects from the aerial parts of *Andrographis paniculata.* In present work isolated and identified 17 diterpenoid lactones from *A. paniculata* including 2 new compounds, most of the diterpenoid lactonesshowed potent anti-inflammatory activity by reducing the secretion of IL-6 and TNF-α in LPS-stimulated RAW 264.7 macrophages. Author also discovered the key pharmacophores of diterpenoid lactones and developed a QSAR model to illustrate the significant relationship between the chemical structures and anti-inflammatory effects.

Mussard E et al.[28] reported, that *Andrographis paniculata* and its bioactive diterpenoids protect dermal fibroblasts against inflammation and oxidative stress. In the study, methanol extract with the bioactive compound ANDRO (comprising 0.87% of ANDRO) showed a high antioxidant effect in HDFa cells. The methanol extract had the highest levels of bioactive compounds, followed by ethanol, water and chloroform. A large quantity of alkaloids,

saponins, flavonoids, tannins, terpenoids and steroids has been found, including the highest amount of andrographolide.

Liang Yet al. [29] reported, chromosome level genome assembly of *Andrographis paniculata.* In the present study, analyzed the Cyp450 gene family in *A. paniculata*, and identified 205 putative CYP450 genes with conserved motifs. The results showed that all major classes of Cyp450 reported by the Nutzmann and Osbourn (2014) could be found in the *A. paniculata* genome. The number of Cyp450 genes with high expressions is larger in roots than in leaf. In the *A. paniculata* genome, author identified a total of 53 putative terpene synthase genes, most of which belong to the TPS-a and TPS-b subfamilies.

Macaranga peltata

Subrahmanyam VMet al.[30]reported, antibacterial and antifungal potentials of *macaranga peltata*. The results showed that leaf yields 47% methanolic extract and 30% methanolic extract obtained from stem bark. In the study also concluded that leaf extract having better antibacterial activity against gram positive microbes than gram negative microbes.

Bijesh K et al. [31] reported, isolation and characterization of antibacterial compounds from *Macaranga peltata* against clinical isolates of Staphylococcus aureus. The antimicrobial effect of methanol extract of *M. peltata* leaves may be due to the individual activity or synergistic activity of these identified phytochemical compounds. The following compounds identified by LCMS techniques, compounds are shikmic acid, Musennin, Rhamnetin, Lupeol acetate, Corilagin and Quercetrin.

Verma M et al.[32] reported, antibacterial and antifungal potentials of *macaranga peltata.* Theleaf and stem bark samples collected, shade dried and powdered. The methanol extracts of these samples were obtained by soxhlet extraction method. The yield obtained from leaf was 47% and from stem bark

was 30%. Both the extracts proved moderate anti-bacterial activity, among them leaf extracts showed better anti-bacterial activity than the stem bark extract against both gram-positive and gram-negative bacteria.

Magadula JJ[33] reported,a review ofphytochemical and pharmacologicalactivity of the genus *Macaranga*. The 300 known species of *Macaranga* plants, less than 30 plant species have been investigated phytochemically, this calls for further work to be done on other known species of this genus. The major classes of compounds reported in the literature include flavonoids, stilbenes, terpenes, tannins, coumarins and others. The pharmacological review of the genus indicated many flavonoids and stilbenes to be isolated from the leaves and exhibited strong, moderate to weak anticancer properties, also showed significant antioxidant, anti-inflammatory and antimicrobial activity

Badarudheen R et al.[34] reported, antibacterial activity of *Macaranga peltata.* The comparison of zone of inhibition in study indicates that methanolic extract of stem and leaves has better antibacterial activity than the acetone and petroleum ether fruit extract.

Nehete M et al. [35]reported,the antioxidant, antimicrobial and wound healing potential of *macaranga peltata* bark extracts. The study confirmed that *Macaranga peltata* bark methanol extract having antimicrobial, antioxidant and wound healing activity

Palakka S et al.[36] reported, antioxidant property of extracts of *Mecaranga peltata* by DPPH free radical scavenging activity. In the result the extracts demonstrated promising antioxidant activity, antioxidant activity correlated with phenolic content. The ethanol extract proved to be having highest antioxidant activity.

Palakka S et al. **[37] reported,***In vitro* anticancer screening of ethanolic extracts of *Macaranga peltata* leaves. The ethanolic extract of *Macranga*

peltata leaves were subjected to MTT assay using HeLa and SK-Mel-28 cell lines. The extract gave promising result for the anticancer activity on both the cell lines with better effectiveness against the cervical cell cancer.

Thrinitha B et al. **[38]reported,** hepatoprotective activity of various extracts of *Macaranga peltata* (Roxb.) on paracetamol-induced hepatotoxicity rats. The administration of methanolic concentrates of *Macaranga peltata* attenuated the hepatic marker enzymes and silymarin restored enzyme activities to normal values.

NOTE:

The study highlights the efficacy of “Traditional Medicine" which is an ancient tradition, used in some parts of India. This ancient concept should be carefully evaluated in the light of modern medical science and can be utilized partially if found suitable.

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