IJFANS INTERNATIONAL JOURNAL OF FOOD AND NUTRITIONAL SCIENCES
ISSN PRINT 2319 1775 Online 2320 7876
 UGC CARE Listed (Group -I) Journal Volume 12, Iss 1, 2023

EXPLORING Ageratum conyzoides L.: PHYTOCONSTITUENTS, BIOLOGICAL ACTIVITIES, AND APPLICATIONS

Niranjan Babu Mudduluru[*1], Shareef Shaik Mahammad[2]
[1,2]Department of Pharmacognosy, Seven Hills College of Pharmacy, Tirupati, A.P., India

Corresponding Author
Dr. M. Niranjan Babu
Professor, Department of Pharmacognosy Seven Hills College of Pharmacy, Tirupati, A.P., India – 517561, Contact: 7702484513, Email: principal.cq@jntua.ac.in

Abstract
Ageratum conyzoides L., commonly known as goat weed or billygoat weed, belongs to the Asteraceae family and is an annual aromatic herb found in tropical and subtropical regions worldwide. It has a rich history of traditional medicinal uses. Extracts from *Ageratum conyzoides* contain essential oils and secondary metabolites with diverse pharmacological potentials, including medication, drug discovery, and development. This article provides a comprehensive review of *Ageratum conyzoides*, focusing on its active phytoconstituents responsible for its various pharmacological and agricultural applications. The herb is also noted for its efficacy in monitoring aflatoxin contamination in feed and food, thereby safeguarding stored products.

Keywords: *Ageratum conyzoides*, Billy goat, Goat weed, Drug discovery, Aflatoxin contamination.

Introduction

Ageratum conyzoides, also known as Babadotan and belonging to the Asteraceae family, is native to Central America, Africa, Asia, and specific islands. It typically grows in waste areas, gardens, forest edges, and near roadsides. This annual plant is characterized by its hairy stems, branching structure, reaching up to 1 meter in height, and ovate leaves that are approximately 7.5 cm long, covered in fine white hairs. The flowers range from white to purple, emitting an aromatic odor and possessing a slightly bitter taste, while the fruits are achenes that disperse easily.

The name "ageratum" originates from the Ancient Greek word "geras," meaning "stay young," and "conyzoides," derived from "konyz," which means "plants". In English, it is known as "goat weed" due to its characteristic goat-like scent. In India, the plant is referred to by various names across different languages, such as Visamustih (Sanskrit), Visadodi (Hindi), Uralgidda (Kannada), and BhedaaJhaar (Nepali). In Assam, it is commonly identified as Gondhoa-bon [1].

Ageratum conyzoides is extensively used as a medicinal plant globally, with traditional uses spanning various therapeutic activities including anticancer, analgesic, anthelmintic, antipyretic, anti-inflammatory, antidiabetic, hepatoprotective, anti-ulcer, cytotoxic, radioprotective, antimicrobial, anticonvulsant, antitumor, insecticidal, and gastroprotective properties. In Africa, it has been historically employed for wound dressing, treating

constipation, and reducing fever. In Togo, it is utilized for snake bites and measles treatment, while in Nigeria, it is used for skin diseases, diarrhea, wound healing, and children's naval pain [2].

All parts of *Ageratum conyzoides* L. plant are utilized as a medicinal herb: leaves are used to prevent tetanus, roots treat diarrhea, infantile tumors, and lithiasis, while flowers alleviate itching, insomnia, coughs, and act as a tonic and antibiotic against parasites. Additionally, besides its medicinal uses, it is recognized for its role in agriculture as an organic substance that enhances soil nutrient composition [3].

Phytochemical Constituents

Ageratum conyzoides L. is rich in phytochemical constituents essential for its medicinal properties, including terpenoids, saponins, tannins, steroids, alkaloids, flavonoids, and phenols, making it a potent source of medicine. These secondary metabolites are synthesized by the plant to protect itself from predators such as microorganisms, insects, and herbivores.

Research highlighted in indicates that leaf extracts of *Ageratum conyzoides* L. contain quercetin, a phytoconstituent known for its active inhibition of TNF-α. TNF-α plays a crucial role in the inflammation process by degrading matrix metalloproteinase-9 (MMP-9) and collagenase, thereby affecting cartilage degradation. The plant also contains essential oil phytoconstituents, as reported in, such as rhamnoside, scutellarin, kaempferol, chromene, quercetin, stigma-7-en-3-ol, caffeic acid, fumaric acid, stigma sterol, sitosterol, agerato chromene derivatives, and pyrrolidine alkaloid [4].

Biological Activity

a) Anti-inflammatory Activity

Inflammation serves as a natural immune response to trauma, infection, and other disturbances affecting homeostasis, characterized by redness, swelling, and heat. *Ageratum conyzoides* demonstrates significant anti-inflammatory potential, as reported by and, inhibiting tumor necrosis factor 9 (TNF), nitric oxide metabolites (NOx), matrix metalloproteinase-9 (MMP-9), and interleukin 10 (IL-10). Experimental studies cited in evaluated the plant's anti-inflammatory properties using a 1% carrageenan induction process, showing that the extract exhibited anti-inflammatory effects at all doses compared to the control ($p<0.05$). Furthermore, compared to the standard diclofenac sodium, the extract demonstrated quicker onset of action and sustained effects for three hours. The flavonoids present in *Ageratum conyzoides* contribute to its anti-inflammatory effects by stabilizing membranes and preventing protein denaturation. These actions help reduce pro-inflammatory mediators such as interleukin 6 (IL-6), IL-10, IL-17A, nitric oxide metabolites (NOx), interferon gamma (IFN-γ), and TNF [5].

b) Anti-oxidant activity

"Antioxidants play a crucial role in protecting the body from oxidative stress caused by free radicals, which can damage cells. Free radicals contribute to various human health issues such as toxicity, immune dysfunction, diabetes mellitus, aging, cancer, and chronic renal

failure. Aging is characterized by the declining ability of tissues to replace or repair themselves while maintaining normal function and structure.

Ageratum conyzoides is recognized as a valuable source of antioxidants that inhibit the aging process, as documented. The ethanolic extract of *Ageratum conyzoides* has an IC_{50} of 80.7 µg/mL, indicating lower DPPH scavenging activity compared to quercetin, which has an IC50 of 3.25 µg/mL. Additionally, the ethanolic extract shows lower inhibitory efficacy against elastase (IC50 = 45.35 ± 2.2 µg/mL) and collagenase (IC50 = 55.07 ± 1.1 µg/mL) compared to quercetin (IC50 = 11.64 ± 0.67 µg/mL and 19.91 ± 0.46 µg/mL, respectively). Overall, the ethanolic extract of *Ageratum conyzoides* exhibits significant anti-aging and antioxidant properties, although its activity levels are lower than those of quercetin [6].

c) Antimalarial Activity

Malaria remains an ongoing epidemic caused by the parasite Plasmodium falciparum. Traditional medicines like quinine and artemisinin have been used for thousands of years. Due to increasing drug resistance and limited access to effective antimalarial drugs in impoverished areas, herbal remedies have gained popularity in developing countries. These remedies have shown promising anti-plasmodial activities in experimental studies. *Ageratum conyzoides* is recognized as one such herbal agent with antimalarial properties, as reported in studies.

Mice infected with *Plasmodium berghei* were used to assess the in-vivo antimalarial activity of methanolic and aqueous extracts of Ageratum conyzoides through a 4-day suppression test. The aqueous extract demonstrated dose-dependent anti-plasmodial effects, with all fractions showing significant ($p < 0.05$) albeit varying levels of activity. The study results indicate that extracts and fractions of Ageratum conyzoides possess noteworthy antimalarial properties [7].

D) Reproductive Issues

Many herbal medicines historically act as oxytocics, emmenagogues, abortifacients, and contraceptives. Forty-two plants are used to address male and female reproductive problems. Ageratum conyzoides is employed in treating venereal diseases, unexplained women's health symptoms, and prostate issues. In experimental settings, Ageratum conyzoides extract did not significantly affect uterine contractions induced by acetylcholine but effectively suppressed contractions induced by 5-hydroxytryptamine, indicating specific anti-serotonergic activity on isolated uteri. These findings support its traditional use as a spasmolytic [8]."

E) Anti-malarial Activity Anti-microbial Activity

The rise of antibiotic resistance poses a significant global health threat due to misuse and overuse of antibiotics. Methicillin-resistant Staphylococcus aureus (MRSA) is particularly concerning for severe hospital-acquired infections. Medicinal plants are known to produce antimicrobial compounds through their secondary metabolites. The ethanolic leaf extract of *Ageratum conyzoides* exhibits potential antimicrobial properties against MRSA. This activity

was evaluated using the disc diffusion method, where a 12.5% extract concentration showed a 25.1 mm inhibitory zone with an MIC value equivalent to 4.46 x 10^-6 g of gentamicin. The presence of secondary metabolites such as tannins, saponins, alkaloids, flavonoids, and essential oils likely contributes to this antimicrobial activity. Tannins and flavonoids are known for their antibacterial properties by inactivating enzymes and forming complexes with bacterial cell walls, thus preventing microbial adhesion [9]. Ageratum conyzoides also exhibits antifungal properties attributed to compounds like polymethoxyflavones and precocene II. Research isolated five active antifungal compounds from the ethanolic extract of Ageratum conyzoides and tested them in vitro against *Rhizoctonia solani* and *Pyricularia oryzae*. The leaf extract effectively suppressed the growth of *Rhizoctonia solani* and *Pyricularia oryzae* in a dose dependent manner, with estimated IC50 values of 250–275 µg/mL against *Pyricularia oryzae* and 400–450 µg/mL against *Rhizoctonia solani*.

F) Anti-Cancer

Cancer is a pervasive disease worldwide, prompting significant interest in discovering novel anticancer drugs from natural source. Ageratum conyzoides has shown inhibitory effects against various cancer cell lines. According to [22], crude extracts of *Ageratum conyzoides* were tested for cytotoxicity using the in vitro MTT assay on four cancer cell lines: normal human prostate (PNT2), breast (MCF-7), prostate (LNCap), and leukemic (Jurkat). The extract exhibited the highest cytotoxicity with an IC50 of 408.15 ± 23.25 µg/mL in leukemic cell lines. However, the leaf extract did not significantly affect LNCap or MCF-7 cells (IC50 > 1000 µg/mL). The study also assessed the selectivity index (SI) values using PNT2 cells, where the aqueous leaf extract showed a slightly superior cytotoxic selectivity on Jurkat cell lines (SI = 2.5) compared to curcumin (SI = 2.3). Flavonoids are believed to contribute to the anticancer properties of *Ageratum conyzoides*. The strong cytotoxic selectivity between cancerous and healthy cells suggests that Ageratum conyzoides may harbor components suitable for developing novel anticancer medications [10]."

g) Wound Healing Activity

Ageratum conyzoides is recognized for its significant role as a wound dressing material. In a study by [6], the methanolic leaf extracts of *Ageratum conyzoides* demonstrated reduced inflammatory cell numbers compared to honey and control sections, indicating its potential in wound healing. Similarly, research found that *Ageratum conyzoides* extracts promote collagen production and cellular proliferation in wounds, resulting in accelerated healing characterized by enhanced wound contraction, epithelialization rates, and improved histological outcomes. Tissue treated with *Ageratum conyzoides* extract showed a 40% increase in tensile strength, highlighting its efficacy in wound healing.

h) Anti-Neuropathic Pain Activity

Neuropathic pain significantly contributes to global disease burden. In Indonesia, *Ageratum conyzoides* L has traditionally been used for pain management, though its application in neuropathic pain is less studied. The essential and non-essential oil constituents of A. conyzoides L were evaluated for anti-neuropathic analgesic activity using thermal hyperalgesia and allodynia tests on chronic constriction injury animal models. Naloxone, an

opioid receptor antagonist, was used to investigate the involvement of opioid receptors in the action of the most effective anti-neuropathic pain component.

The essential oil component exhibited significantly greater anti-neuropathic analgesic activity compared to its non-essential oil counterpart and negative control groups. Moreover, it demonstrated efficacy comparable to pregabalin. The activity was attenuated by naloxone, suggesting the essential oil component's action involves opioid receptors. Thus, the essential oil component of *Ageratum conyzoides* L presents itself as a promising candidate for unique neuropathic analgesic applications.

i) Anti-coccidial Activity

Coccidiosis is a disease that causes enteritis, mortality, decreased production, and reduced feed conversion efficiency. It also leads to bloody droppings due to rapid invasion and division of coccidia, damaging the intestinal epithelium. In ethnoveterinary practice, powdered dried whole plant of *Ageratum conyzoides* is used in drinking water to treat coccidiosis in birds. The ethanolic extract of *Ageratum conyzoides* has shown potential anti-coccidial action against *Eimeria tenella*.

In a study, twenty-five growing broilers were divided into five groups, each orally administered 8000 oocysts of infection. Group C received Amprolium in drinking water for seven days, while groups A and B received extract concentrations of 500 and 1000 mg/kg, respectively, fifteen days post-infection. Negative and positive controls were represented by groups D and E. All treatment groups showed a gradual reduction in faecal oocyst counts, eventually reaching zero. Treated birds exhibited significantly ($P < 0.05$) higher packed cell volumes, red blood cell counts, and weight compared to the infected untreated control group, supporting its use in ethnoveterinary practices for managing coccidiosis.

j) Anti-Aflatoxin Activity

Aflatoxin contamination, primarily from *Aspergillus parasiticus* and *Aspergillus flavus* infections, poses a significant food safety concern, affecting over 25% of the global food supply annually due to mycotoxins. *Ageratum conyzoides* L. contains essential oils with twelve compounds that completely inhibit the development and production of toxigenic aflatoxin strains, such as *Aspergillus parasiticus*. At a concentration of 0.5 mg mL−1, it demonstrated 84% inhibition of aflatoxin production. Thus, this plant shows promise in monitoring and controlling aflatoxin contamination in food and protecting stored products.

k) Herbicidal Activity

Ageratum conyzoides, classified as a weed, is among the most economically damaging weeds globally. It contains plant growth inhibitors useful for developing natural herbicides. Research highlighted the herbicidal activity of *Ageratum conyzoides* in paddy fields against *Echinochloa crusgalli* var. formosensis Ohwi and effectively inhibited the growth of *Aeschynomene indica* L. and *Monochoria vaginalis* (Burm.f.) Pers. The stem, leaves, and roots contain three different phenolic components: coumaric acid, protocatechuic acid, and

gallic acid. Additionally, the leaves extract contains three potential allele chemicals sinapic acid, p-coumaric acid, and benzoic acid that contribute to higher suppression of leaves compared to roots and stems.

CONCLUSION

Ageratum conyzoides has been extensively explored, and this review provides detailed information on its phytochemistry and its applications in pharmacology, agriculture, and the food industry. Comprehensive research on this plant could potentially transform *Ageratum conyzoides* from a nuisance weed into a valuable resource.

REFERENCE

1. B. Sutjiatmo. Antioxidant and Antiaging Assays of *Ageratum conyzoides* (L.) Ethanolic Extract. Pharmaceutical Sciences and Research, vol. 7, no. 3, Dec. 2020, doi: 10.7454/psr.v7i3.1061.
2. T. C. Shekhar and A. Goyal, „A Comprehensive Review on *Ageratum conyzoides* Linn. (Goat weed)“, 2012. [Online]. Available: www.eijppr.com
3. R. Kaur, B. Singh, and S. Kaur. Pharmacognostic studies on leaves of *Ageratum conyzoides* Linn“. Journal of Pharmacognosy and Phytochemistry, vol. 7, no. 3, 2018.
4. A. L. Okunade, „ž / *Ageratum conyzoides* L. Asteraceae“, 2002.
5. A. Jyoti Prasad BaruaAyub Ali Ahmed SailenGogoiSamiran Pathak PreetiHatibarua, J. Prasad Barua, A. Ali Ahmed, S. Gogoi, S. Pathak, and P. Hatibaruah, „THE HOME GARDEN OF ASSAM“.
6. J. C. Kotta, A. B. S. Lestari, D. S. Candrasari, and M. Hariono, „Medicinal Effect, in Silico Bioactivity Prediction, and Pharmaceutical Formulation of *Ageratum conyzoides* L.: A Review“, Scientifica, vol. 2020. Hindawi Limited, 2020. doi: 10.1155/2020/6420909.
7. N. Yadav, S. A. Ganie, B. Singh, A. K. Chhillar, and S. S. Yadav. Phytochemical constituents and ethnopharmacological properties of *Ageratum conyzoides* L.“, Phytotherapy Research, vol. 33, no. 9. John Wiley and Sons Ltd, pp. 2163–2178, Sep. 01, 2019. doi: 10.1002/ptr.6405.
8. A. Anhar, R. Junialdi, A. Zein, L. Advinda, and I. Leilani, „Growth and Tomato Nutrition Content with Bandotan (*Ageratum Conyzoides* L) Bokashi Applied“, in IOP Conference Series: Materials Science and Engineering, Institute of Physics Publishing, Apr. 2018. doi: 10.1088/1757-899X/335/1/012017.
9. D. W. Harjanti, R. Ciptaningtyas, and F. Wahyono. Phytochemical properties and antibacterial activity of Ageratum conyzoides, Piper betle, *Muntingacalabura* and Curcuma domestica against mastitis bacteria isolates“, in IOP Conference Series: Earth and Environmental Science, Institute of Physics Publishing, Apr. 2019. doi: 10.1088/1755-1315/247/1/012049.
10. S. A. I. Maulidya, D. A. Nuari, S. Suryana, and S. Almarifah. Antibacterial Activity of Bandotan (*Ageratum conyzoides* L) Leaves Extracts Against Methicillin-Resistant Staphylococcus aureus“, Borneo Journal of Pharmacy, vol. 3, no. 4, pp. 243–248, Nov. 2020, doi: 10.33084/bjop.v3i4.1552.