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(Review Article)

A Comprehensive Review on *Ageratum conyzoides* Linn.(Goat weed)

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ABSTRACT

Ageratum conyzoides Linn.(Family: Asteraceae) a medicinal plant as a whole was commonly known as Goat weed or Appa grass is widely distributed over the tropical and subtropical regions of the world. It is an annual branching herb which grows up to 1 m in height. The stems and leaves are covered with fine white hairs. A wide range of chemical compounds including alkaloids, flavonoids, chromenes, benzofurans and terpenoids have been isolated from this species. Extracts and metabolites from this plant have been found to possess pharmacological and insecticidal activities. *Ageratum conyzoides* is used in various parts of Africa, Asia and South America for curing various diseases in the folk medicine. It is used as a purgative, febrifuge, against colic, skin ulcers, as an antienteralgic and antipyretic, for cuts as a wound dressing.

Keywords: *Ageratum conyzoides*; Flavonoids; Chromenes; Benzofurans; Alkaloids; Terpenoids; Bioactivity.

INTRODUCTION

Since ancient times plants are used as rich source of medicine. Scientific exploration of traditional knowledge of use of herbs in treatment of various ailments is one of the thrust areas of research. Herbal medicines are in great demand in the developed as well as developing countries for primary healthcare because of their wide biological and medicinal activities, higher safety margins and lesser costs. *Ageratum conyzoides* is widely utilized in traditional medicine systems wherever it grows, although applications vary by region. Traditional communities in India use this plant as a bactericide, antidiarrheal, and antilithic. and in Asia, South America and Africa, aqueous extract of this plant is used as a bactericide¹. In Central Africa it is used to treat pneumonia, but the most common use is to cure wounds and burns. *Ageratum conyzoides* is also utilized to treat fever, rheumatism, headache and colic. The medicinal value of this plant in the treatment of a large number of human ailments is mentioned in Ayurveda, Charaka Samhita and Sushruta Samhita².

It is an annual branching herb which grows to approximately 1 m in height. The stems and leaves are covered with fine white hairs, the leaves are ovate and up to 7.5 cm long. The flowers are purple to white, less than 6 mm across and arranged in close terminal inflorescences. The fruits are achene and are easily dispersed. The plant grows commonly in the proximity of habitation, thrives in any garden soil and is very common in waste places and on ruined sites³. It has a peculiar odor likened in Australia to that of a male goat and hence its name 'goat weed' or 'billy goat weed'.

Ageratum conyzoides has bioactive activity that may have agricultural use, as shown by several research investigations in different countries. Pereira in 1929, cited by Jaccoud (1961), reported use of the leaves as an insect (moth) repellent. The insecticide activity may be the most important biological activity of this species⁴. *Ageratum* is derived from the Greek "a geras," meaning non-aging, referring to the longevity of the flowers or the whole plant. The specific epithet "conyzoides" is derived from "kónyz," the Greek name of *Inula helenium*, which it resembles. The presence of *Ageratum conyzoides* can also be used as an seed inhibitor, decreasing development of several herbaceous plants. an aqueous extract of the aerial part or roots of this species (15 g of aerial part or 3 g of roots in 100 ml of water, during 24 h) inhibited germination of wheat and rice seeds. It grows well on wastelands and in fields after the rainy season⁵.

SYNONYMS

Hindi : Jangli pudina, uchunti; **English:** Goat weed, Billygoat weed, Chicken weed ; **Spanish (El Salvador):** Mejorana, **sunsumpate (Columbia):** Yerba hemostatica **Portuguese:** Mentrasto, Tropic ageratum **African Vernacular Names**
West Africa (Igbo): Nri-ewu (Yoruba): Imieshu , yarnigbei.

TAXONOMICAL CLASSIFICATION

Kingdom : Plantae
Subkingdom : Angiosperm
Class: Eudicots

Order:Asterales
 Family:Asteraceae
 Genus:Ageratum
 Species:conyzoides

Binomial name: *Ageratum conyzoides* Linn.

BOTANICAL DESCRIPTION

Ageratum conyzoides (Fig.1) is a small herbaceous plant belongs to the family Asteraceae. It is softly hairy, erect, branched, annual weed up to 80-90 cm in height. It is a tropical plant used in various parts of Africa, Asia and South America for curing various diseases. The stems and leaves are covered with fine white hairs; the leaves are ovate and up to 7.5 cm long. The flowers are purple to white, less than 6 mm across and arranged in a terminal inflorescence. The fruits are achenes and easily dispersed. Because of its propagation it become a weed and causes problems for farmers and ecologists. Seeds are positively photoblastic, and viability is often lost within 12 months. It is not eaten by men because of its bad odour, like a male goat and is named goat weed or billy goat weed. The whole plant is only used for medicinal purposes and has a long history in the folk medicine of different countries⁶.

PHYTOCHEMICAL CHARACTERISTICS

There is high variability in the secondary metabolites of *A. conyzoides* which include flavonoids, alkaloids, cumarins, essential oils, and tannins. Many of these are biologically active. The oil content varies randomly from 0.11 to 0.58% for leaves and from 0.03 to 0.18% for the roots depending on times of the year. From water distillation of the fresh flowers, the oil content was found to be 0.2%. The yield of oil from the petroleum ether extract of the seed was 26%. A large number of constituents have been identified from the GC-MS analysis of the essential oil of *Ageratum conyzoides*⁷⁻⁸. The largest so far, a total of 51 constituents have been reported from the analysis of an oil sample of the plant. The constituents identified include 20 monoterpenes 6.4% and 20 sesquiterpenes 5.1%. The mono- and the sesquiterpenes are obtained in minute quantities trace-0.1%. The monoterpenes obtained in approximately 1% of the oil include sabinene and β -pinene, 1.6%, β -phellandrene, 1,8-cineole and limonene, 2.9%, terpinen-4-ol, 0.6%, and α -terpineol, 0.5%. Ocimene which is found in trace amount in the oil from the Nigerian plant, is found to be 5.3% of the oil from the plant collected in India. α -Pinene 6.6%, eugenol 4.4% and methyleugenol 1.8% are also obtained from the Indian plant oil⁸.

The most common component of the essential oil of *Ageratum conyzoides* is 7-methoxy-2,2-dimethylchromene (precocene-I)(1). Other related compounds obtained from the oil include enecalinal(6), 6-vinyl-7-methoxy-2,2-dimethylchromene(7), dihydroencecalinal(9), dihydrodemethoxyencecalinal(10), demethoxyencecalinal(11), demethylenecalinal(12) and 2-(1-oxo-2-methylpropyl)-2-methyl-6,7-dimethoxychromene(14). The presence of these acetyl chromenes in *Ageratum conyzoides* is believed to be of chemotaxonomic significance⁸.

In addition to the chromenes obtained from the oil, seven other chromene derivatives are isolated from hexane extract of the aerial part of the plant. These are 2,2-

dimethylchromene-7-O-glucopyranoside(13), 6-(1-methoxyethyl)-7-methoxy-2,2-dimethylchromene(3), 6-(1-hydroxyethyl)-7-methoxy-2,2-dimethylchromene(4), 6-(1-ethoxyethyl)-7-methoxy-2,2-dimethylchromene(5), 6-angeloyloxy-7-methoxy-2,2-dimethylchromene(8) and an inseparable mixture of enecanescins(20-22). Benzofuran derivatives, 2-(2'-methylethyl)-5,6-dimethoxybenzofuran(17), 14-hydroxy-2H, β -3-dihydroeuparine(18) as well as chromone derivatives, 3-(2-methylpropyl)-2-methyl-6,8-dimethoxychrom-4-one(15) and 2-(2-methylprop-2-enyl)-2-methyl-6,7-dimethoxychroman-4-one(16) have also been reported from the plant⁸.

Ageratum conyzoides is rich in polyoxygenated flavonoids, 21 of them have been reported in the whole plant. Among them there are 14 polymethoxylated flavones(23-36). These polyhydroxyflavones include quercetin, kaempferol and their glycosides, too. The two major common sterols sitosterol and stigmasterol together with minor sterol were isolated together with the triterpene friedelin(41). Other common substances are sesamine, fumaric acid, caffeic acid, phytol, and long chain hydrocarbons. The polyhydroxyflavones include scutellarein-5,6,7,4-tetrahydroxyflavone, quercetin, quercetin-3-rhamnopyranoside(37), kaempferol, kaempferol-3-rhamnopyranoside(38-39) and kaempferol 3,7-digluco-pyranoside. The isoflavone obtained from the plant was reported by a group of Indian researchers⁸⁻⁹. The chemical structures of all above phytoconstituents are represented in Fig.2-5.

PHARMACOLOGICAL ACTIVITIES

Crude extract

It has been found to have neuromuscular blocking activity. The leaf extract has been used in the treatment of chronic pain in osteoarthrotic patients. Its antimicrobial and anticonvulsant activities have also been demonstrated. The methanolic extract of the whole plant also has antimicrobial activity. The analgesic activity of the leaf extract was detected by hot plate method¹⁰.

Essential oil

Essential oil of *A. conyzoides* has been tested for anti-inflammatory, analgesic and antipyretic activities in mice and rats. At doses of 3 and 4 ml/kg per os, the oil was found to have a significant anti-inflammatory (cotton pellet granuloma) activity¹¹.

Metabolites

Pharmacological activities of the most significant metabolites, besides the essential oil from this plant, responsible for the medicinal properties have not been identified. There are, however, a wide spectrum of pharmacological activities of the classes of compounds obtained from this plant. For example, simple chromenes and chromans especially the 6-amino and 6-acetamido derivatives have been reported to have anti-depressant, analgesic and antipyretic properties¹²⁻¹³. Other simple 2,2-dimethyl chromene derivatives like 6-(1-hydroxyethyl)-7,8-dimethoxy-2,2-dimethylchromene and 6-hydroxy-7,8-dimethoxy-2,2-dimethyl chromene have been shown to have antimicrobial activities. The sterols, especially stigmasterol, have been shown to exert significant anti-inflammatory activity. The flavonoids possess a wide range of biological

activities. The free radical scavenging and anticancer activities of the flavonoids are of public knowledge¹³. Even though the biological activities of the flavonoids isolated from *Ageratum conyzoides* have not been investigated.

Some of the important pharmacological properties exhibited by *Ageratum conyzoides* Linn includes:

A)Antibacterial effects

Water and ethanol extracts of the shredded fresh collected plant were investigated for antibacterial activity. In an in vitro anti-methicillin resistant *Staphylococcus aureus* test (MRSA) the minimum inhibition concentration (MIC) 30.6 to 43.0 and 45.4 to 71.0 $\mu\text{g}/\text{kg}$ were recorded for ethanol and water extracts. The minimum bactericidal concentration (MBC) was higher for both extracts.

B)Anti inflammatory effects

A hydroalcoholic extract was studied for anti inflammatory effects in rats. A group of rats, orally treated with 250 mg/kg extract had a 38.7 % reduction in the cotton pellet-induced granuloma. The development of chronically induced paw edema was also reduced significantly by the plant extract.

C)Wound healing effects

The wound healing effect of the *Ageratum conyzoides* methanolic extract was studied in Wistar rats (n=10). Wounds prepared in excised areas of the skin were packed with gauze soaked by the extracts and were determined histologically after 10 days. The *Ageratum* sections showed fewer inflammatory cells and more fibrosis than controls¹⁴.

D)Spasmolytic effects and gastro protection

The ethanol extract of *Ageratum conyzoides* was evaluated for gastroprotection in rats using the ibuprofen, ethanol and cold restraint ulcer stress model. Efficacy was assessed by determination of mean ulcer size, ulcer numbers and an ulcer index¹⁵.

E)Antitumour activity

In a murine ascites Dalton's lymphoma in vivo the aqueous extract of *Ageratum conyzoides* roots decreased glutathion in the liver and in the lymphoma cells of the tumour-bearing mice¹⁶.

INSECTICIDAL ACTIVITIES

Ageratum conyzoides has bioactivity that may have agricultural use. The insecticidal activity may in fact be the most important biological activity of this species. Both the essential oil as well as the major components of the oil, namely the precocenes, have been reported to have antijvenile hormonal activity¹⁷.

ALLELOPATHY

Both the volatile oil and the aqueous extract of the *Ageratum conyzoides* have been shown to have allelopathic effects on a number of cultivated crops. The saturated aqueous solution of the isolated and purified precocene I and II have been reported to have significant inhibitory effect on the seedling growth of radish, tomato and ryegrass. The allelopathic potential of the aqueous extract from different organs of *Ageratum conyzoides* and from its different development stages especially from different habitats, was different¹⁸⁻²⁰.

CONCLUSION

Ageratum conyzoides has been widely studied. It is believed that a detailed information as presented in this review on its phytochemistry and various biological properties of the extracts and the constituents might provide incentive for proper evaluation of the use of the plant in medicine and in agriculture. Further work, however, still needs to be carried out on the toxicity of the plant and especially on some flavonoids as Quercetin, which have been shown in few cases to cause antilithiatic effect in rats.



Fig.1: *Ageratum conyzoides* Linn., Asteraceae

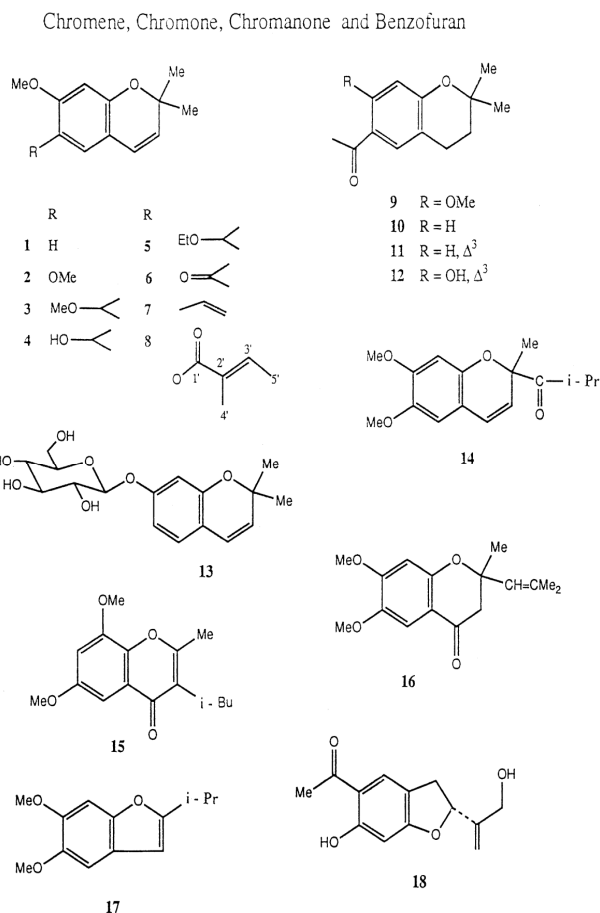
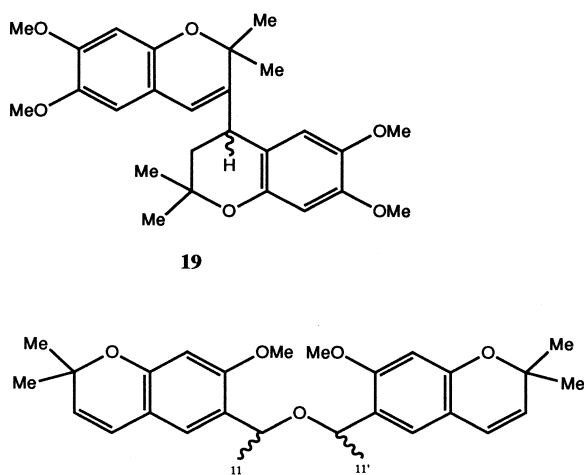


Fig.2: Phytochemical structures (1-18)

Chromene Dimer



- 20 11 α - Me, 11' β - Me
- 21 11 β - Me, 11' β - Me
- 22 11 β - Me, 11' α - Me

Fig.3 Phytochemical Structures (19-22)

Flavonoids

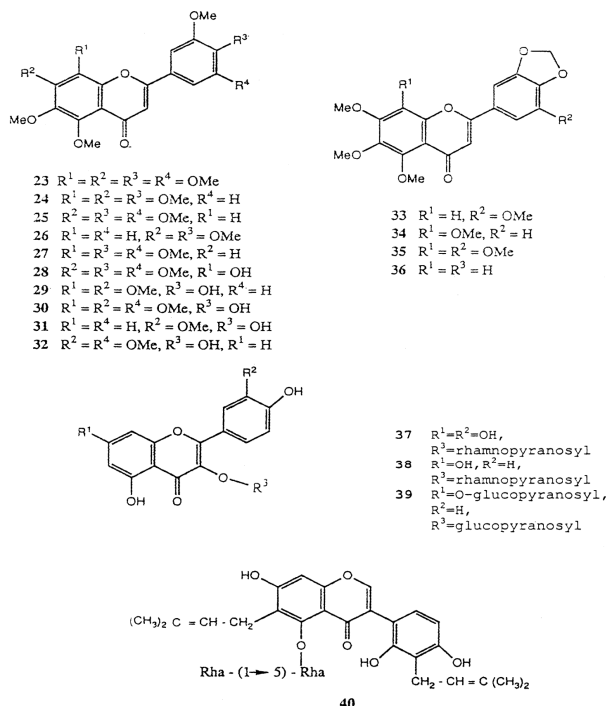


Fig.4: Phytochemical Structures (23-40)

Triterpenoid and Sterols

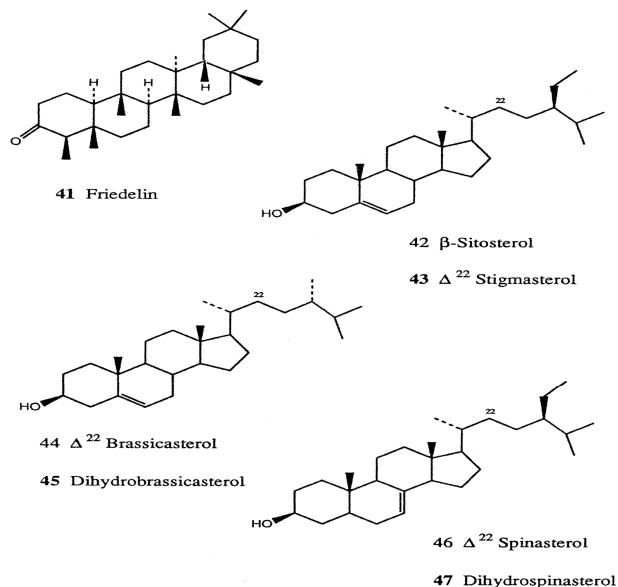


Fig.5: Phytochemical Structures (41-47)

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