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An overview of Ageratum conyzoides L. its Phytoconstituent and Biological activity

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ABSTRACT
Ageratum conyzoides L. belongs to family Asteraceae, an annual aromatic herb most commonly known as goat weed orbillygoat weed. It is found in tropical and sub-tropical region of the world with a long-term history of traditional medicinal practices. Extracts of Ageratum conyzoides contains essential oils and secondary metabolites which havevariouspotencies includes medication, drug discovery and development.This article gives complete reviews of the plant Ageratum conyzoides, its active phytoconstituents present in the herb which are responsible forits numerous potential values in pharmacological and in agricultural field.The herb is also known to be beneficial in monitoring aflatoxin contamination in feed and food and thereby protecting the stored products.

KEYWORDS: Ageratum conyzoides, Billygoat**,** Goat weed, Drug discovery, Aflatoxincontamination

I. INTRODUCTION

Ageratum conyzoidesalso known as BabadotanofAsteraceae family and is found in Central America, Africa,Asia and south specific Islands[1]. It growsaround the wastearea, garden, forestedges, near rod sites etc[2].It is an annual hairy plant with branching and growsup to 1m high and ovate shaped leaves with 7.5 cm long and stems are covered with white fine hairs[3]. The flowers are white to purple with an aromatic odour and slightly bitter in taste whereas fruits are achene and easily dispersed[3][4].

The name ageratum comes from the Ancient Greek words "geras," which means "stay young," and "conyzoides," came from the word “konyz” which means "plants"[2]. This herb is known as "goat weed" in English, native to tropical America and has a goat-like scent[5].In India,according to various language the plant has given diferent names such as Goat weed (English), Visamustih (Sanskrit), Visadodi (Hindi), Uralgidda (Kannada) and BhedaaJhaar (Nepali)[2].It is commonly identified as Gondhoa-bon in Assam[6].

Ageratumconyzoides L. an annual medicinal plant utilisedtraditionally in many countries of the world.It has various therapeutic activities such as cancer, analgesic, anthelmintic, anti-pyretic, anti-inflammation, anti-diabetes, hepatoprotective, anti-ulcer, cytotoxic, radio protective, anti-microbial, anti-convulsant, anti-tumour, insecticidal, and gastro protective. In Africa, the plant has been widely used for wound dressingand to relive constipation and fever.In Togo,it is used for the treatment of snake bites andmeasles. It is used to treatskin diseases, diarrhoea, wound healing and naval pain in children of Nigeria [7].

The entire part of Ageratum conyzoides L. plant has been used as medicinal herb. The leaves are used to prevent tetanus,the roots are used to treat diarrhoea, baby tumours andlithiasis. The flower helps torelive itching, insomnia,cough,tonic and antibiotic parasites[8]. Moreover, with its medicinal useit is also reported for being used as an organic substance in agriculture that can improve the nutrient composition of the soil[9].

II. PHYTOCHEMICAL CONSTITUENTS

Ageratum conyzoides L. comprisesof phytochemical constituents such as terpenoids, saponins,tannins, steroid, alkaloid,flavonoid andphenol which is an efficient source of medicine[10].They synthesized these secondary metabolites to safeguard themselves from predators such as microorganisms, insects and herbivores[11]. From the study reported by[12],the leaves extract of Ageratum conyzoides L. contain phytoconstituent quercetin which act as active TNF –α inhibitor. Inflammation process is degraded byTNF- α by degrading its matrix metalloproteinase-9(MMP-9) as well as

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collagenase of cartilage [12]. It also contains essential oil phytoconstituent reported by [8]which includes thatrhamnoside, scutellarin, kaempferol, chromene, quercetin,stigma-7-en-3-ol, caffeic acid, fumaric acid,stigma sterol,sitosterol, agerato-chromene derivatives and pyrrolidine alkaloid.

III. BIOLOGICAL ACTIVITY

a) Anti-inflammatory activity

Inflammation is a natural biological immunity response for trauma, infectionand other component that affects the homeostasis. Redness, swelling and heatidentifies inflammation. The purpose of the acute inflammatory response is reducing tissue impairment. The plant Ageratum conyzoidesexhibits potential anti-inflammatory action reported by[13]&[12] by inhibiting tumour necrosis factor 9 (TNF), nitric oxide metabolites (NOx),matrix metalloproteinase-9 (MMP-9), interleukin 10 (IL-10). From the experimental study reported by [13], anti-inflammatory assay was studied by using 1% carrageenan induction process. The result displayed extract at all doses exhibited anti-inflammatory activity as compared to the control ($p<0.05$). When compared to standard diclofenac sodium, the extract had a quicker start of action and was stable for three hours.The anti-inflammatory properties of Ageratum conyzoideshave the ability to stabilize membranes and prevent protein denaturation because of the presence of flavonoids. This anti-inflammatory effect reduces pro-inflammatory mediators like interleukin 6 (IL-6), 10 (IL-10) and 17A (IL-17A), nitric oxide metabolites (NOx), interferon gamma (IFN-γ)and tumour necrosis factor 9 (TNF).

b) Anti-oxidant activity

Antioxidant are vital compounds that have potential of protecting the body againstoxidative stress caused by free radicals which can harm cells.The effects of free radicals on humans include toxicity, immunological dysfunction, diabetes mellitus, aging, cancer, and chronic renal failure [14].Aging is defined as ability of declining tissues to replace or repair themselves and maintaining their structural and normal function. Ageratum conyzoidesis considered as a good source of antioxidants and inhibits theprocess of aging as reported by[7][1]&[13].From the study reported by[1], IC_{50} of 80.7 µg/mL of the ethanolic extract of Ageratum conyzoides has lesser DPPH scavenging activity than normal quercetin, which has an IC_{50} of 3.25 µg/mL. In comparison to quercetin withIC_{50} = 11.64 ± 0.67 µg/mL and 19.91 ± 0.46 µg/mL, theethanolic extract of Ageratum conyzoidesshowed lesser inhibitory efficacy against elastase and collagenase (IC_{50} = 45.35 ± 2.2 µg/mL and 55.07 ± 1.1 µg/mL, respectively). Overall, ethanolic extract of Ageratum conyzoidesholdsgood antiaging and antioxidant activities that prevents the process of aging although the activities are lower than quercetin.

c) Anti-malarial activity

Malaria is ever-continuing epidemic caused due to the causative agentPlasmodium falciparum. Quinine and artemisinin have been used as traditional medicines for thousands of. As there is increased level of resistance to drug and difficulties in poor areas for the access to the effective antimalarial drugs, herbal remedies for the treatment are popular and practiced in developing countries which have showed quite good anti-plasmodial activities in experimental studies[15].Ageratum conyzoides is also considered as antimalarial agent from the study reported by[15]&[16]. According to the study reported by [16],the mice was infected with causative agent Plasmodium bergheiand screened in-vivo for the antimalarial activity of methanolic and aqueous extract followed by suppression test of 4-days. The Ageratum conyzoides'aqueous extract revealed dose dependent anti-plasmodial action. All the fractions exhibited significant ($p < 0.05$), but variable levels of anti-plasmodial activity. Result from the study suggested that leaves extract and fractions of Ageratum conyzoidesholds significant antimalarial property.

d) Reproductive Problems

Many herbal medicines have historically been used as oxytocics, emmenagogues, abortifacients, and contraceptives. Fourtytwo plants are used to treat male and female reproductive issues. Ageratum conyzoidesis also utilised to treat venereal disease, unexplained symptoms from women, and prostate issues. The Ageratum conyzoidesextract showed no significant impact on uterine wall contractions caused via acetylcholine, but it suppressed contraction of uterusthat is induced through 5-hydroxy tryptamine, indicating specific anti-serotonergic activity of the extract on isolated uterus. The findings validate the plant widely used as spasmolytic [17].

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e) Anti-microbial activity

Resistance to antibiotic is well-thought-outto be amajor threat to universal health because of the development of resistance towardsnumber of antibiotics caused through overuse and misuse of antibiotics. Methicillin-resistance Staphylococcus aureus (MRSA) is considered as the causative agent for severe nosocomial infections[18]. Various studies reported that the medicinal florasoffer antimicrobial compounds derived from its secondary metabolites. Study of[11]stated thatthe ethanolic leaves extract of Ageratum conyzoidesserves potential antimicrobial property against Methicillin-resistance Staphylococcus aureus (MRSA). The activity was evaluated by disc diffusion method and at12.5% extract concentration it showed 25.1 mm inhibitory zone with MIC value equals to 4.46 x 10^{-6} g of gentamicin[11].The activity may be because of the presence of secondary metabolites that is tannins, saponin, alkaloid, flavonoid and essential oils[10].Tannins and flavonoids have been reported to own antibacterialproperty because oftheir ability to inactivate enzymes and form complex with the bacterial cell wall, microbial adhesion[19]. Ageratum conyzoidesis also known to have antifungal property because of the presence of compounds such aspolymethoxyflavones andprecocene II. The study of[20] reported to isolatefive antifungal active compounds after ethanolic extraction ofAgeratum conyzoidesand assayed in-vitroagainst Rhizoctoniasolani andPyriculariaoryzae. The result indicates that the leave extract was able to suppress the growth of Rhizoctoniasolani and Pyriculariaoryzaein a dose-dependent manner and estimated $IC_{50}$is 250–275 µg/mL against Pyriculariaoryzaeand 400–450 µg/mL against Rhizoctoniasolani.

f) Anti-Cancer

Cancer is known to be the most widespread diseases in humankindboth in developed and developing countries and is considered as commercial and scientific interest for the discovery of novel anticancer drugs from natural sources[21]. Ageratum conyzoidesexhibited inhibitory action on wide range of cancer cell lines. According to the study of [22],crude extract of Ageratum conyzoideswas measured for cytotoxic efficacy using in-vitro MTT assay on four cancerous cell lines; normal human prostate (PNT2), breast (MCF-7), prostate (LNCap) and leukemic (Jurkat).The extract of Ageratum conyzoidesshowed the greatest cytotoxicity with IC_{50} = 408.15±23.25 µg/mlin the leukemic cell lines. On the other hand, neither LNCap nor MCF-7 cells were cytotoxically affected by the leaf extract (IC_{50}> 1000 µg/ml). The PNT2 was used to examine the crude extracts in order to determine their selectivity index (SI) values. When compared to curcumin (SI=2.3), the aqueous leaf extract showed somewhat superior cytotoxic selectivity on Jurkat cell lines (SI=2.5). According to the study of [21], flavonoids may be the cause of Ageratum conyzoides' anticancer properties. Strong cytotoxic selectivity among cancer and healthy cell lines raises the possibility that the plant Ageratum conyzoides contains a component or compounds that might be the basis for novel anticancer medications [22].

g) Wound Healing activity

Ageratum conyzoidesis expressively considered as a wound dressing material. In a study done [23] to examine the wound-healing activity of methanolic leaves extracts of Ageratum conyzoides, theinflammatory cells were observed reduced in numbers in Ageratumconyzoides sections in-comparison to honey and control sections.In a similar research of[24], extract of Ageratum conyzoides showed to promote collagen production and cellular proliferation in wounds. Wounds treated with the extract ofAgeratum conyzoides healed more quicker, as evidenced by improved rates of wound contraction and epithelialization as well as histological results. Tensile strength was 40% higher in the treated tissue. Therefore, it has been demonstrated that using Ageratum conyzoides topically speeds up the healing of wounds.

h) Anti- Neuropathic pain activity

Neuropathic pain contributes to be a factor in global burdens of ailment.In Indonesia,Ageratum conyzoides L has been used in the treatment of painyet it'sutilization in neuropathic pain is unidentified. Essential and non-essential oil constituentof A. conyzoides L. was studied for anti-neuropathic analgesic activity via thermal hyperalgesia and allodynia tests on chronic constriction injury animal models. To explore the role of opioid receptors against the most effective anti-neuropathic pain component, naloxone was used. The essential oil component showed significantly greater activity in the neuropathic analgesicaction when comparing withits non-essential oil constituent and negative groups.Additionally, essential oil component

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demonstrated efficacy compared to that of pregabalin. Naloxone, on the other hand, eliminated this activity, suggesting that the opioid receptor plays a role in the action of the essential oil component. Consequently, A. conyzoides L's essential oil component presents itself as a potentially unique material for neuropathic analgesic[25].

i) Anticoccidial activity

Coccidiosis, a disease which causes enteritis, mortality, decreased production, and decreased feed conversion efficacy [26]. Additionally, bloody droppings are passed because the intestinal epithelium is damaged by coccidia, which invade and divide quickly.Powder of dried whole plantof Ageratum conyzoides was employed in drinking water to treat coccidiosis-stricken birds in ethnoveterinary field practice. Ethanolic extract of Ageratum conyzoideswas reported to hold potential anti-coccidialaction against Eimeria tenella. Twenty-five number of growing broilerswere splited into five groups and each group received 8000 oocysts of the infection orally. The clinical signs of each group included depression, weight loss, droopy wings, pasty vents, huddlingand ruffled feathers. Group C was given Amprolium in drinking water for seven days, whereas groups A and B were administered with extract of concentration 500 and 1000 mg/kg, respectively, fifteen days after infection. Negative and positive controls were represented by groups D and E. All treatment groups had a gradual decline in the number of faecal oocysts per gramof faeces, ultimately reaching zero. The treated birds' packed cell volumes, red blood cell counts and weightwere considerably ($P < 0.05$) greater than that of the infected untreated control group. This attests to its utilization in ethnoveterinary for the management of coccidiosis [27].

j) Anti- aflatoxin

The contamination of aflatoxin can arise from a number of sources, although infections with Aspergillus parasiticus and Aspergillus flavus are the main causes. Every year, more than 25% of the worldwide food supply is contaminated by mycotoxins. Naturally occurring aflatoxins are B1, B2, G1, and G2 that contaminates wide range of goods[28]. Ageratum conyzoidesL. is rich in essential oil that showed the presence of twelve compounds which can completely inhibits thedevelopment and production of the toxigenic aflatoxin strain Aspergillus parasiticus. It showed inhibition of 84% aflatoxin productionat 0.5 mg mL^{-1} concentration. Thus, the weed can be beneficial in monitoringand regulating aflatoxin contamination in food as well as protecting the stored products [29].

k) Herbicidal activity:

Ageratum conyzoides is considered as weed and is listed among the most economically destructive weeds in the world. The plant is abundant with plant-growth inhibitors which is useful in developinga natural herbicide[30]. [31]reported on the herbicidal activity of Ageratum conyzoides in paddy fields against formosensis Ohwi. Echinochloa crus-galli var. and entirely inhibited the appearance of Aeschynomeneindica L. and Monochoria vaginalis (Burm.f. Persilvar.plantagineaSolms.)The stem, leavesand root were found to contain three different phenolic components: coumalic acid, protocatechuic acid and gallic acid. Additionally, three possible allelochemicals, sinapic acid, p-coumaric acid and benzoic acid were discovered in the leaves extract which results in the higher suppression of the leaves than that of the root and stem.

IV. CONCLUSION

Ageratum conyzoides has been explored widely and detailed information is presented in this review on its phytochemistry and usefulness in pharmacological, agricultural as well as in food industry. It is believed that comprehensive investigation of the plant might help to turn a nuisance weedthat is Ageratum conyzoides, into a useful resource.

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