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Phytochemistry, Pharmacological Activity, Traditional & Medicinal Uses of Erigeron Species: A Review

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Abstract
The genus Erigeron is widely distributed in Asia, North America and Europe & Genus Erigeron mainly grown as ornamental plant in gardens of India. Different species of Erigeron like Erigeron ramosus, Erigeron annuus, Erigeron linifolius, Erigeron breviscapus Erigeron floribundus, Erigeron multiradiatus, Erigeron canadensis posses different activities such as antibacterial, anti-oxidants, anti-inflammatory activities etc . Essential oils are nearly common to all species, Although other chemical constituents like flavonoids, glycosides, alkaloids, saponins are also reported in the genus.

1. Introduction

According to the World Health Organization (WHO), the use of herbal remedies throughout the world exceeds that of the conventional drugs by two to three times.27 Herbal medicine is still the mainstay of about 75 - 80% of the world population, mainly in the developing countries, for primary health care. 28 This is primarily because of the general belief that herbal drugs are without any side effects besides being cheap and locally available.29 The WHO has recently defined traditional medicine (including herbal drugs) as comprising therapeutic practices that have been in existence, often for hundreds of years, before the development and spread of modern medicine and arestill in use today. Traditional medicine is the synthesis of therapeutic experience of generations of practicing physicians of indigenous system of medicine. Traditional preparations comprise medicinal plants, minerals and organic matter etc. Herbal drugs constitute only those traditional medicines which primarily use medicinal plant preparations for therapy. The earliest recorded evidence of their use in Indian, Chinese, Egyptian, Greek, Roman and Syrian texts dates back to about 5000 years. The classical Indian texts include Rigveda, Atharvaveda, Charak Samhita and Sushruta Samhita. The herbal medicines / traditional medicaments have therefore been derived from rich traditions of ancient civilizations and scientific heritage.28

2. Drug Profile

The genus Erigeron (Compositae) comprises more than 200 species in the world, of which 35 are widely distributed in China [34.] Some of them have a long history of applications in Chinese folk medicine, especially Erigeron annuus (Linn.) Pers. This plant has been used as a traditional medicine for the treatment of indigestion, enteritis, epidemic hepatitis, and hematuria [35.] Previously investigation revealed that this plant contains monoterpenoids, sesquiterpenoids, diterpenoids, triterpenoids, and phenolic derivatives[36-39.] The genus Erigeron is a common group of Compositae plants. Erigeron annuus (L.) Pers. (himejyon in Japanese), is now as naturalized weeds, widely distributed throughout urban and rural areas of Japan.[40] The leaves of E. canadensis have been reportedly used to prepare a tonic efficient in the treatment of diarrhea, diabetes and hemorrhages.[41,42] Erigeron linifolius is widely distributed throughout the tropics. In the Philippines, the leaves are used for the treatment of rheumatism and as prevention for too rapid conception. A cataplasm of the fresh plant is applied on wounds, contusions and dislocations.[43]Erigeron karvinskianus DC. in Central America was treated broadly by D'Arcy [30] and Nash,[31] but significant variation has escaped notice in such an inclusive view. This species, which probably occurs natively only in Mexico and Central America, and a group of lesser known close relatives have been recognized as Erigeron sect. Karvinskia Nesom,[32] one of relatively few groups of Erigeron whose evolutionary radiation has been restricted to Mexico and Central America. Three of the species are endemic to Mexico: E. heteromorphus B.L. Rob., E. fluens Nesom, and E. barbarensis Nesom & Van Devender. Erigeron bonariensis (L.) is a common weed distributed from plains to 1800 m height in North-West Frontier Province, Punjab and Balochistan in Pakistan[47]In india it is found in hills regions of Nainital, although this genus is widely grown in gardens as ornamental plant.[13]

3. Geographical Distribution

The genus Erigeron (Compositae) is widely distributed in Asia, North America and Europe. There are about 35 species distributed in China, some of which have a long history of application in Chinese folk medicine.[45] In India it is found in mountainous region of Nainital.[13]

Phytochemistry

Mathela C.S. et al.,(2014); Studied three Himalayan Erigeron species viz Erigeron mucronatus, Erigeron annuus *and* Erigeron karwinskianus growing in sub-alpine region the study revealed occurrence of isomeric polyacetylenic constituents viz., matricaria and lachnophyllum esters which accounted

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for 83.3%, 69.3% and 30.1% of the essential oils from these species, respectively, in addition to mono- and sesquiterpenoids as minor constituents.. Essential oils contains Monoterpene hydrocarbons(α-Pinene, Sabinene, Myrcene, β-(E)-Ocimene, p-Menthatriene), Sesquiterpene hydrocarbons(Germacrene-D, Isoledene, α-Copaene, β-Cubebene, etc.), Oxygenated sesquiterpenes(Caryophyllene oxide, Cubebol, Humulene epoxide II, α-Cadinol, β-Eudesmol, etc.), Polyacetylenic esters(cis-Lachnophyllum ester, trans-2-cis-8-Matricariaester). Antifungal activities of essential oils were also studied. The antifungal activity tested by poisoned food (PF) techniques against Fusarium oxysporum, Helminthosporium maydis, Rhizoctonia solani, Alternaria solani and Sclerotinia sclerotiorum demonstrated significant inhibition of the mycelial growth of all strains ($p < 0.05$). The oils (500 µ/mL) showed significant antifungal effect against tested fungi in the growth inhibition range of 37.6-85.5% with respective IC50 values ranging from 88.8 to 660.0 µmL as compared to standard fungicides (100% inhibition) with IC50 value in the range of 32.2 -129.4 µ/mL.[14]

Joshi et al., (2011); studied antimicrobial activity of the essential oils of Erigeron floribundus. The essential oils of Erigeron floribundus was screened against 10 human pathogenic bacteria and fungi .The oils was found active against Staphylococcus aerous, E.coli, Candida albicans, Aspergillus niger, Sacharomyces cerevaceae and Penicillium chrysogenum with minimum inhibitory concentration of 0.41 ± 0.18, 0.72 ± 0.47, 0.36 ± 0.23, 0.45 ± 0.28, 0.57 ± 0.59, 0.88 ± 0.63 mg/ml respectively. Essential oils of Erigeron floribundus was found more active against tested fungal strains. [7]

Rahman et al., (2010); reported anti-fungal activity in methanolic extract of essential oils of Erigeron ramosus. The hydro-distilled essential oil was analysed by GC-MS. Thirty one compounds representing 95.3% of the total oil were identified, of which β-caryophyllene (24.0%), α-humulene (14.5%), 1,8-cineole (9.0%), eugenol (7.2%), globulol (7.1%), caryophylleneoxide (5.2%), δ-cadinene (5.0%), α-copaene (4.9%) and widdrol (2.0%) were the major compounds. The air-dried leaves and stems of E. ramosus were pulverized into powdered form. The dried powder (50 g) was extracted three times with 80% methanol (200 ml) at room temperature and the solvents from the combined extracts were evaporated by a vacuum rotary evaporator. The methanol extract (5.7 g) suspended in water and extracted successively with hexane, chloroform and ethyl acetate to give hexane (1.98 g), chloroform (1.26 g) and ethyl acetate (0.88 g) and residual methanol fractions (0.78 g), respectively. The efficacy of the essential oil and methanolic extracts of Erigeron ramosus, was evaluated for controlling the growth of some important phytopathogenic fungi. The fungal species used in the experiment were Fusarium oxysporum (KACC 41083), Phytophthora capsici (KACC 40157), Colletotricum capsicid (KACC 410978), Fusarium solani (KACC 41092), Rhizoctonia solani (KACC 40111)& Sclerotinia sclerotiorum (KACC 41065) & zone of inhibitions were found to be 19.0±0.5, 13.4±0.5, 19.6±0.5, 15.6±0.4, 17.9±0.7, 14.5±0.3 respectively.[1]

P. Luoa et al., (2008); reported anti-inflammatory activity of the extracts of Erigeron multiradiatus through bioassay-guided procedures. Erigeron multiradiatus, an herb that grows in the alpine and subalpine meadow of Qinghai-Tibet plateau, has been widely used as a folk remedy by the native people for treatment of various inflammatory ailments. In order to isolate and identify the active components of Erigeron multiradiatus for anti-inflammatory activity, a preliminary phytochemical study and a bioassay-guided fractionation and purification process was performed. The dry whole plant Erigeron multiradiatus was extracted with 50% ethanol and then separated into CHCl3, n-BuOH, and aqueous fractions. The anti-inflammatory activities of each fraction were investigated using two in vivo inflammation models. n-BuOH fraction showed the strongest anti-inflammatory activities. The dry whole plant Erigeron multiradiatus was extracted with 50% ethanol and then separated into CHCl3, n-BuOH, and aqueous fractions. The anti-inflammatory activities of each fraction were investigated using two in vivo inflammation models. Results exhibited varying degrees of anti-inflammatory activities and the n-BuOH fraction showed the strongest anti-inflammatory activities. The n-BuOH fractionwas then subjected to separation and purification using macroporous resins column chromatography and Sephadex LH-20 leading to two flavonoids glucuronides identified as scutellarein-7-O-β-glucuronide and apigenin-7-O-β-glucuronide. Furthermore, LC–MS/MS identification and quantification of isolated compounds were also performed. Scutellarein-7-O-β-glucuronide and apigenin-7-O-β-glucuronide were considered as major components and principally responsible for the anti-inflammatory activity of Erigeron multiradiatus. [8]

lee et al., (2006); reported antioxidant property of Erigeron annus & it may be due to the presence of phenolic compounds. The antioxidant activity of extract of E. annus assesses by means of two different in-vitro tests: bleaching of the stable 1, 1-diphynyl-2-picryl hydrazyle radical (DPPH test) and scavenging of authentic peroxynitrite in company with peroxynitrite generation from 3-morpholinosyndnolimine (SIN-1). In tests, the 85% aqs MeOH and n-BuOH solubule fractions of crude drug extract showed a significance scavengeing effect on peroxynitrite and DPPH radical in comparison to L-ascorbic acid. And bioassay guided fractionation of n-butenol solubule fraction lead to isolation of three compounds (1) Apigenin, (2) Quercetin. (3) caffeic acid.[3]

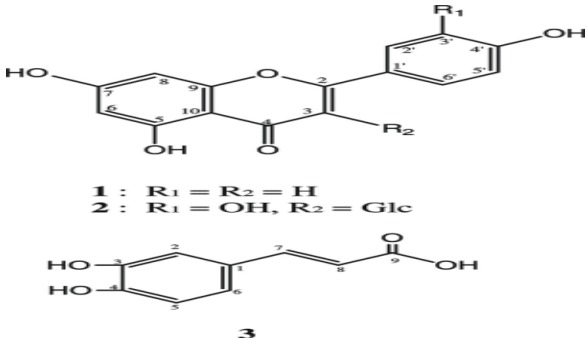

Fig: 1. Chemical structures of the active compounds isolated from Erigeron annuus

Gang et al., (2006); reported acetone extracts of Erigeron acer & find two new butenolide derivatives, named as erigeracerin A and erigeracerin B. The dried and powdered

whole plant of Erigeron acer (5.5 kg) was extracted 3 times with acetone at room temperature. The combined extracts were evaporated to dryness (172.5 g) under reduced pressure. Then the residue was separated by column chromatography over 1800 g silica gel. Structures were elucidated by spectroscopic analysis including 2D NMR and HR-ESI-MS. [11]

E.A. Asongalem et al., (2004); reported analgesic and anti inflammatory activities of an aqueous extract of Erigeron floribundus) or (syn": Conyza sumatrensis). The analgesic investigation has been carried out against two types of noxious stimuli, chemical (formalin-induced pain and acetic acid-induced writhing) and thermal (hotplate and tail immersion tests). The effects following aspirin and naloxone pretreatments were also studied. For the anti-nflammatory activities, the carrageenan-induced odema of the hind paw of rats was used and the paw volume measured plethysmometrically from 0 to 24 h after injection. This was compared to a standard drug indomethacin (10 mg/kg). It decreased the writhings of acetic acid-induced abdominal contractions and lickings of formalin-induced pain. Aspirin had no effect on hotplate and tail immersion tests but showed an effect on writhing test. These results showed that the plant had both central and peripheral acting effects and this was confirmed by its effect on both phases of formalin-induced pain. The extract also significantly decreased the rat paw oedema volume at 50 mg/kg and above. In conclusion, Erigeron floribundus has central and peripheral analgesic properties as well as Anti-inflammatory activities. Alkaloids, saponins, tannins, glycosides, phenols flavonoids and oils were identified.[6]

H. Liu et al.(2003); evaluated ethanol extract of Erigeron breviscapus & found that it showed moderate antibacterial activity and a high antifungal activity. Antibacterial activity tested (using Kanamycin as standard) against (Gram (+) bacteria such as Staphylococcus aureus, Enterococcus faecalis & Gram (-) bacteria such as Escherichia coli, Shigella flexneri, Serratia liquefaciens, Enterobacter aerogenes, Pseudomonas cepacia, Pseudomonas putrefaciens). Antifungal activity tested (using ketokonazole as standard), against fungi such as Candida albicans, Candida tropicalis, Candida parapsitosis, Aspergillus penicilloides, Aspergillus candidus.[5]

Curini M.et al., (2003); reported the composition and in-vitro antifungal activity of essential oils of Erigeron Canadensis. The essential oil of Eigeron canadensis contained 18 compounds, limonene being the main one (76.03%), essential oils were seen to exert good antifungal activities. three phytopathogenic fungi Rhizoctonia solani, Fusarium solani (Mart.) Sacc. and Colletotrichum lindemuthianum. R. solani growth is slightly inhibited only at the highest dose (1600 ppm) using the essential oil of Er. canadensis, F. solani growth was very little inhibited (4.50%) using the essential oil of Er. canadensis at a dose of 400 ppm, but increasing the dose up to 1600 ppm increased the percentage of inhibition slightly (12.71%). C. lindemuthianum growth inhibition was 18.75% at a 400 ppm dose of the essential oil of Er. canadensis and increased up to 29.27% at 1600 ppm.[9]

C.Y. RAGASA et al.,(1997); isolated two novel acetylated pinene glucosides from Chloroform extract of Erigeron linifolius leaves.Their structures were elucidated by 1D and 2D NMR and FT-IR spectroscopy and mass spectrometry. The relative stereochemistry of the glucosides was established by a combination of coupling constant analyses and NOESY. [4]

Pieribattesti. et al., (1987); reported the major compounds present in essential oil of Erigeron karvinskianus. These were β -ocimene(15.7%), β-caryophyllene (6.8%), β- pinene (3.3%), camphene, β-cubebene (2.1%), Gemacrene D(21%), γ-cadinene (8%) etc. He conducted the steam distillation methods for the isolation of essential oils from whole plant. The oils were fractioned by column chromatography on silica gel. The hydrocarbons were eluted with hexane, and more polar constituents with acetate and with methanol. The essential oils and fractions were analyzed by gas chromatography.[12]

Mathela et al., (1984); reported ethanolic extracts of aerial part of Erigeron karwinskyanus. The extract subjected to column chromatography (silica gel). Elution with methanol yielded amorphous solid which was purified by HPLC and recrystalized from methanol to white needles. The compound was found to be 3-hydroxy-4-pyron 3-a-D-glycopyranoside. Its structure was established on the basis of spectral data (IR. Mass, proton NMR).[13]

Claude et al., (1981); isolated the terpenoids & polyacetylenic esters of the essential oil of Erigeron naudini. Compounds identified in the essential oil of E. naudini was hydrocarbons-a-pinene, β-pinene, myrcene, limonene, β-elemene. The essential oil of E. naudini was obtained with an average yield of 0.2% by hydrodistillation of the whole plant during 3 hr distillation. The monoterpenic hydrocarbons, which represent approximately 50% of the essential oil, were separated almost entirely by fractional distillation; limonene was the major constituent. The distillation residue was then separated into two parts by Si gel chromatography; the hydrocarbons were eluted with hexane and the more polar constituents with with methanolic. The fraction composed only of hydrocarbons, the majority being sesquiterpenic, was analysed by GC-MS.[51]

4. Traditional Uses

Since Roman times Erigeron has been used as a natural insecticide to repel fleas. Just growing it in garden controls insects, but can also rub the leaves on clothing or paths to also repel mosquitoes, flies, gnats and ticks.In Italian folk medicine roots of **E. acris** are used topically to heal toothache, bruises and arthritis.[46] Erigeron floribundus has multiple traditional uses including rheumatism, gout, cystitis, nephritis, dysmenorrhoea, dental pain, head ache[18,19]. For dental pain, fresh leaves are ground to paste and applied whenever necessary to the painful tooth. For dysmenorrhoea, 200 g of dried leaves are boil in 1 lit. of water for 2 hr, cooled, filtered and 100 ml taken thrice a day [6]. This plant has been found to have anti inflammatory activity on mice [24]. Since the plant is used traditionally in the treatment of painful illnesses like dysmenorrhoea and inflammatory diseases like gout, cystitis, nephritis and rheumatic arthritis, it became worthwhile to evaluate its antinociceptive and antiinflammatory activities in rats and mice.[6] Erigeron acer is used to relieve toothache and arthralgia.[17]Erigeron breviscapus was used for the treatment of cerebral infarction and peripheral circulatory problems [20,

[21]. It has also been reported to have anti ischemia/ reperfusion injury and to inhibit platelet aggregation activity, used for the treatment of paralyzed and rheumatism pain in traditional Tibetan medicine.[22, 23]. Erigeron multiradiatus in traditional Tibetan medicine for years to treat various diseases related with inflammation such as rheumatism, hemiparalysis, hyperpiesia, hepatitis, adenolymphitis and enteronitis.[25]Erigeron annuus In Chinais used as a traditional medicine for the treatment of indigestion, enteritis, epidemic hepatitis and hematuria .[26] Erigeron bonariensis (L.) is found in Pakistan & locally called "gulava" or "mrich booti" is traditionally used in urine problems.[47]

5. Medicinal uses

It is medicinally used as Analgesic & Anti-inflammatory (*Erigeron floribundus*). [6] Antibacterial and antifungal (*Erigeron breviscapus*)[5.] Anti-inflammatory (*Erigeron multiradiatus*)[8.] Antifungal (*E. ramosus*, *E. Canadensis*). [1, 9]Antimicrobial (*E. linifolius*). [4] Anti-oxidant (*Erigeron annuus).*[3]

6. Pharmacological activity

Following activities were found in genus *Erigeron*, Anti-inflammatory.[6,8], Antibacterial[5] Antimicrobial[4], Antifungal[1,5,9] Anti-oxidant.[3]

7. Conclusion

It is concluded that the genus Erigeron contain essential oils, glycosides, tanins, flavonoids, quercetin etc as a chemical constituents. Different species of genus Erigeron were analysed for composition & activity & found that they have various activity like antimicrobial, antifungal, anti-inflammatory, antioxidant, analgesic etc. There are various other species excluding above are not tested for activity such as Erigeron latus, Erigeron hybridus etc. Erigeron might be potential sources for improved traditional medicines or new agents for the treatment of various diseases.

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