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A Review on "Erigeron Canadensis" Growth Dynamics and Seed Dispersal Mechanisms

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Abstract: *Erigeron canadensis, a flowering plant in the family Asteraceae, is sometimes referred to as horseweed or Canadian fleabane. It is native to North America, has adapted well to a range of habitats, and is frequently found in fields, disturbed areas, and by the sides of roadways. With thin, leafy stems topped with clusters of tiny, white to pinkish flowers that bloom from late spring to fall, the plant normally reaches a height of 30 to 100 cm.*
Erigeron canadensis (synonym Conyza canadensis) is an annual plant native throughout most of North America and Central America. It is also widely naturalized in Eurasia and Australia. Common names include horseweed, Canadian horseweed, Canadian fleabane, colts tail, marestail, and butterweed. It was the first weed to have developed glyphosate resistance, reported in 2001 from Delaware.

Keywords: a review on "erigeron canadensis" growth dynamics and seed dispersal mechanisms

I. INTRODUCTION

Erigeron canadensis, a flowering plant in the family Asteraceae, is sometimes referred to as horseweed or Canadian fleabane. It is native to North America, has adapted well to a range of habitats, and is frequently found in fields, disturbed areas, and by the sides of roadways. With thin, leafy stems topped with clusters of tiny, white to pinkish flowers that bloom from late spring to fall, the plant normally reaches a height of 30 to 100 cm.

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Auxin herbicide treatment specifically increased the expression of 9-cis-epoxycarotenoid deoxygenise (NCED), a crucial gene involved in the biosynthesis of abscisic acid. Abscisic acid (ABA) production increased quickly as a result of the rise in NCED expression after auxin herbicide treatment. Both a decrease in cell turgor and an increase in ethylene levels—two hypothesized catalysts for fast ABA biosynthesis—were not associated with this rise in ABA levels. When plants neared death, the amounts of ABA in their leaves following auxin herbicide administration increased even more, reaching >3 times the levels in drought-stressed plants' leaves (1).

Reactive oxygen species (ROS) are created when radiation interacts with oxygen, which mediates radiation harm. These then interact with essential cellular macromolecules, resulting in intracellular metabolic disruptions and oxidative damage to the molecules reactions of oxidation and reduction (2).

Radioprotectors can serve as preventative measures to protect tissues and cells from radiation's damaging effects. The screening of various synthetic compounds was the main focus of earlier research in the creation of radioprotectors globally. It hasn't been very successful, mostly because of their toxicity and adverse consequences (3,4). The

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polyphenol rings' structure and the presence of several hydroxyl (-OH) groups give flavonoids their potent antioxidant and radioprotective qualities (5).

Cyanate is widely known to prevent the physiological reactions in organisms including plants and mammals as an herbicide (6,7). Invasive non-native plant species usually cause harm to the local ecosystems in which they have been introduced. They can change how ecosystems work, outcompete native plant species, lower biodiversity, and have a significant economic impact (8,9,10).

The harmful effects of ionizing radiation (IR) are mediated by direct energy deposition onto the target biological molecule (DNA, proteins, lipids, and sugars) and by the interaction of the reactive. Together with these biological components are nitrogen and oxygen species (ROS/RNS). Damage to the DNA and the membrane might result in cell death. The effects of infrared radiation can be significantly mitigated at the molecular, cellular, and tissue levels by plant phenolic compounds, including anthocyanins, flavonoids, stilbenes, phenolic acids, tannins, etc (11, 12).

The plant has been utilized in traditional medicine in the northern regions of Pakistan to address a range of health issues, such as severe pain, inflammation, fever, and microbial infections like urinary tract infections, respiratory infections, diarrhea, and dysentery (13).

The antibacterial properties of Erigeron canadensis were examined against eight pathogenic bacteria: Pseudomonas aeruginosa, Vibrio cholerae, Escherichia coli, Shigella dysenteriae, Shigella flexneri, Bacillus subtilis, Micrococcus luteus, and Staphylococcus aureus. The ethanolic extract of the flowers demonstrated the greatest inhibition zone (17 mm) against P. aeruginosa, while it exhibited the lowest inhibition zone against B. subtilis (5 mm). The methanolic extract of the flowers showed the largest inhibition zone against E. coli, with the smallest zone observed against M. luteus. No inhibition zones were detected in the ethanolic and methanolic stem extracts of the plant (14).

The impact of Erigeron canadensis extract on melanogenesis and cell toxicity was examined in cultured B16F10 mouse melanoma cells. The extract of Erigeron canadensis effectively reduced melanin production at a concentration that was non-toxic. It was separated into five different fractions. One of these fractions demonstrated a 48.0% inhibition of melanin production at a concentration of 100 mg/ml, making it 2.5 times more effective than the depigmenting effects of the commercial agent arbutin (17.5%), while also exhibiting no cell toxicity. The in vitro and cellular activity of tyrosinase, along with antioxidant activity and the protein levels of key melanogenic enzymes such as tyrosinase, TRP-1, and TRP-2, were assessed to clarify the depigmenting mechanism of this particular fraction. This fraction inhibited melanin production in B16F10 melanoma cells by reducing the protein levels of melanogenic enzymes, particularly tyrosinase (15).

The flowering regions of this plant typically possess greater concentrations of polyphenolics than its stems, leaves, and roots (16).

Phytochemical research on Conyza canadensis has uncovered the existence of C10 acetylenes, sesquiterpene hydrocarbons, flavonoids, sterols, triterpenes, and sphingolipids.(17,18).

The genus Conyza Less., part of the Asteraceae family, includes approximately fifty species found globally. In Turkey, the Conyza genus is represented by three species: Erigeron canadensis (L.) Cronquist, Erigeron bonariensis (L.) Cronquist, and Erigeron albida(19,20).

The plant exhibited a broad spectrum of pharmacological effects, encompassing antimicrobial, antioxidant, anticancer, hypolipidemic, cardiovascular, central nervous system, respiratory, immunological, anti-inflammatory, analgesic, antipyretic, and several other therapeutic properties and effects (21,22).

Erigeron canadensis (also known as Conyza canadensis L.) is commonly referred to as "Canadian fleabane" or "horseweed." This plant species is indigenous to North America and is also commonly found across Europe. It is an annual herb that grows upright, producing one or more sparsely hairy stems that can attain heights of 10 to 180 cm (23).

It has also been indicated to possess properties that protect against ischemia/reperfusion injuries and to reduce platelet aggregation activity. In traditional Tibetan medicine, it is utilized for treating paralysis and rheumatic pain (24).

Research has shown that this plant exhibits anti-inflammatory effects in mice. Given that it has a traditional application in managing painful conditions such as dysmenorrhea and inflammatory diseases including gout, cystitis, nephritis, and rheumatoid arthritis, it became important to assess its antinociceptive and anti-inflammatory properties in both rats and mice (25).

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FTIR spectroscopic analysis indicated the detection of alcohols, phenols, alkanes, alkynes, alkyl halides, aldehydes, carboxylic acids, aromatic compounds, as well as nitro compounds and amines in the ethanol leaf (26).

FTIR examination of the raw methanol extract from Ceropegia juncea indicated the existence of functional groups such as alcohol, aldehyde, alkyne, alkene, and amines, but not esters. The findings of this study align with previous research(27).

Methanethioamide, known as N,N-Dimethyl, is a compound that features a retention time (RT) of 2.792. Its molecular formula is C4H12OSi, with a molecular weight of 104. According to a study by Mallappa Kumara Swamy and colleagues, it has been utilized for its antimicrobial and antioxidant properties derived from various solvent extracts of Malaysian Plectranthusambonicus leaves(28).

Phytochemical research has shown that the primary components of this genus include sesquiterpene lactones, triterpenes, steroids, carotenoids, flavonoids, lignoids, alkaloids, and tannins 18. To date, multiple investigations have been conducted on the essential oils derived from various parts of Erigeron canadensis, such as the leaves, aerial components, and roots obtained from different locations, revealing the of monoterpenes, sesquiterpenes, and acetylene derivative compounds(29,30).

Nevertheless, there have been only a limited number of studies exploring the biological properties of essential oils derived from Erigeron canadensis. These studies indicated that the oils from Erigeron canadensis possess antimicrobial and cytotoxic effects, and they function as a growth inhibitor and impede seed germination in the target plants.(31,32,33)

Stigmasterol is a compound with a retention time value of 51.467. Its molecular formula is C29H48O, and it has a molecular weight of 412. This compound has been utilized in treatments for thyroid inhibition, anti-peroxidative hypoglycemia, and anti-hepatotoxic activities, among various other functions(.34,35).

The effects of the plant extract on plasma proteins regarding their antioxidant and protective qualities were investigated against oxidative and nitrative injuries caused by ONOO-. Peroxynitrite triggered oxidative stress and led to harmful consequences in biological systems, resulting in damage to biomolecules. The extract (at concentrations ranging from 50 to 2500 mg/ml) significantly decreased protein nitration in a dose-dependent manner by 90%. Moreover, the oxidation of plasma proteins was reduced by approximately 75%. ONOO- caused the oxidation of plasma thiol groups, a process which was inhibited by the extract under study. At the lowest concentration of extract (50 mg/ml), the level of reduced protein thiols increased threefold. Conversely, the highest concentration of the extract resulted in a twofold decrease in the levels of reduced protein thiols and raised homocysteine levels by about 4.5 times. Consequently, the extract exhibited antioxidative characteristics in vitro, safeguarded plasma proteins from the toxic effects of peroxynitrite, and influenced the thiol/disulfide redox status.(36)

The study examined how the polysaccharide extract from the plant protects platelet proteins from damage caused by nitration and oxidation due to ONOO−. The plant extract significantly diminished the oxidation and nitration of proteins in blood platelets exposed to ONOO− (0.1 mM) and reduced the production of O2 in these cells. The extract's capability to lower O2 generation in blood platelets highlighted the role of free radicals in platelet activities, including the aggregation process(37).

The impact of various components of the plant extract on platelet aggregation in vitro was examined. Aqueous extracts from both young and old plants, along with the glycoconjugate, polysaccharide, and aglycon components at concentrations exceeding 0.75 mg/ml, effectively inhibited platelet aggregation induced by collagen (2 microg/ml) in a dose-dependent manner. The polysaccharide component derived from the plant extract exhibited the most significant inhibitory effect on collagen-induced aggregation and appears to be responsible for the plant's antiaggregatory properties (38).

The phenolic-polysaccharide derived from Erigeron canadensis demonstrated anticoagulant activity in vivo, which was inhibited by protamine sulfate. It also exhibited anti-platelet effects, specifically limited to the cyclooxygenase pathway triggered by arachidonic acid. To identify which fraction exhibited the highest anticoagulant activity, the plant preparation was subjected to fractionation. The impacts of both the plant preparation and its most potent fraction on the inactivation of thrombin and factor Xa by antithrombin, as well as thrombin inhibition by heparin cofactor II, were evaluated. Both preparations were effective in inhibiting thrombin and factor Xa amidolytic activities in the presence of

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antithrombin; however, significantly higher concentrations of unfractionated heparin were needed to achieve similar effects. The anticoagulant activity mechanisms seem to involve interactions with heparin cofactor II and the inactivation of thrombin(39).

The anti-inflammatory effects and the associated molecular mechanisms of the methanol extract from Erigeron canadensis (ECM) were investigated in LPS-stimulated RAW264.7 macrophage cells. ECM notably reduced the production of inducible nitric oxide (iNOS)-derived NO and cyclooxygenase-2 (COX-2)-derived PGE2 in LPS-stimulated RAW264.7 macrophages. These inhibitory effects of ECM were linked to a reduction in LPS-induced nuclear translocation and activity of NFκB. Additionally, ECM significantly diminished the phosphorylation of mitogen-activated protein kinases (MAPKs) such as extracellular signal-related kinase (ERK1/2), p38, and c-jun N-terminal kinase (JNK) in LPS-stimulated RAW264.7 macrophages (40).

II. PLANT PROFILE

2.1 Erigeron canadensis

Erigeron canadensis, a flowering plant in the family Asteraceae, is sometimes referred to as horseweed or Canadian fleabane. The genus erigeron found in Asia, North America and Europe. It is found in India from Himachal, Mandi. Erigeron canadensis (synonym Conyza canadensis) is an annual plant native throughout most of North America and Central America. It is also widely naturalized in Eurasia and Australia. Common names include horseweed, Canadian horseweed, Canadian fleabane, c

Figure: Leaves and Flowers of Erigeron canadensis

2.2 SYNONYM:

Caenotus canadensis (L.) Raf., Caenotus pusillus (Nutt.) Raf., Conyza canadensis (L.) Cronquist, Conyza canadensis var. glabrata (A. Gray), Conyzella canadensis (L.) Rupr., Erigeron canadense var. pusillus (Nutt.) B. Boivin, Erigeron canadensis f. canadensis, Erigeron canadensis var. canadensis, Erigeron canadensis f. coloratus Fassett, Erigeron canadensis var. glabratus A.Gray, Erigeron canadensis var. grandiflorus Schwein., Erigeron canadensis var. levis Makino, Erigeron canadensis var. strictus Farw., Erigeron myriocephalus Rech. f. & Edelb., Erigeron pusillus Nutt., Erigeron setiferus Post ex Boiss., Leptilon canadense (L.) Britton & Brown, Leptilon canadense (L.) Britton & A. Br., Leptilon canadense var. canadense, Leptilon pusillum (Nutt.) Britton, Marsea canadensis (L.) V. M. Badillo, Senecio ciliatus Walter and Trimorpha canadensis (41).

2.3 TAXONOMIC CLASSIFICATION:

Kingdom	Plantae
Subkingdom	Viridiplantae
Infrakingdom	Streptophyta
Super division	Embryophyta
Division	Tracheophyta
Subdivision	Spermatophytina
Class	Magnoliopsida
Superorder	*Asteranae*
Order	Asterales

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Family	*Asteraceae*
Genus	*Erigeron/ Conyza*
Species	*E. Canadensis*

(42).

2.4 COMMON NAMES:

English	Butterweed, Canadian fleabane, Canadian horseweed, hogweed, horseweed.
French	Vergerette du.
German	Kanadisches, berufkraut.
Swedish	Kanada Inka
Arabic	Theil Elfers, hashes hat El Jabal, nashis El Theban, Asa Kanada, sheikh al-rabi.
Hindi	Gajar Ghass
Sanskrit	Jarayupriya

(43).

2.5 DISTRIBUTION

The plant is distributed in Northern America (Canada, United States and Mexico); Southern America (Belize, Costa Rica; El Salvador, Guatemala, Honduras, Nicaragua and Panama); Africa (Algeria, Libya, Morocco, Tunisia, Lesotho; South Africa, Swaziland); Asia (Armenia, Azerbaijan, Georgia, Russian
Federation, China, Japan, Korea, Taiwan, Palestine, Syria, Iraq and Turkey); Europe (Belarus, Estonia,
Latvia, Lithuania, Moldova, Ukraine, Belgium, Czech, Germany, Hungary, Netherlands, Poland,
Slovakia, Switzerland, Denmark, Finland, Norway, Sweden, United Kingdom, Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Greece, Italy, Macedonia, Montenegro, Romania, Serbia, Slovenia, France, Portugal and Spain) and in Pacific zone (44).

2.6 DESCRIPTION:

Erigeron canadensis is an annual forb that grows in both winter and summer. It is upright, with one or several branches extending 30–150 cm (1–5 feet) in height. Unless the apical growth points have been damaged, stems are normally unbranched at the base. The leaves measure 2 to 8 cm (0.8 to 3.1 in) in length and 2 to 8 mm (0.08 to 0.31 in) in width. They are linear to oblanceolate. The edges of the leaves are serrated and ciliate. A loose panicle is the inflorescence. At 2 to 4 mm (0.08 to 0.16 in) tall and 3 to 7 mm (0.12 to 0.28 in) broad, the many flower heads are tiny. The rays are quite tiny, measuring about 0.5 to 1.0 mm (0.02 to 0.04 in) in length, and they can be white or purple. As an achene, the fruit has a Pappus with white bristles (45, 46, 47).

2.6.1 CULTIVATION:

As Erigeron canadensis can adapt to a range of circumstances, it is a reasonably easy plant to cultivate. Erigeron canadensis can withstand some shade but prefers full sun. Provide at least six hours of direct sunlight each day for optimal flowering. It needs a natural pH that is a little acidic(about6.0–7.5). A gap of 12 to 18 inches was required for proper growth and circulation. Erigeron canadensis requires temperatures of 21°C to sprout from seeds and germinate in 7–14 days. For growth, it requires soil that is relatively moist. As it is usually not required, fertilization can be adjusted for poor soil.

2.7 CHEMICAL CONSTITUENTS:

The essential oil of Er. canadensis contain18 compounds, limonene is one of the main compounds and its percentage is (76.03%). [48]

According to phytochemical analyses, Erigeron canadensis (also known as Conyza canadensis) included flavonoids, anthraquinone, glycosides, tannin, diterpenoids, terpenoids, and saponins. From various plant parts, several sphingolipids, conyzolide, conyzoflavone, conyzapyranone A, conyzapyranone B, 4, Z,8 Zmatricaria- γ-lactone, 4 E,8

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Z-matricaria- γ-lactone, 9,12,13-trihydroxy 10(E)-octadecenoic acid, epifriedelanol, friedeline, taraxerol, simiarenol, spinasterol, stigmasterol, β sitosterol, C10 acetylenes, sesquiterpene hydrocarbons, and numerous sphingolipids were isolated. [49,50,51]

From the plant's epigean section, eight sesquiterpenic hydrocarbons were extracted, including betasantalene, beta-himachalene, cuparene, alpha-curcumene, gamma-cadinene, and three further unidentified hydrocarbons.[52]

The essential oil of Erigeron canadensis from France contained 18 compounds, limonene being the main one (76.03%). The identified compounds were included: α-Pinene: trace, β-Pinene: 1.57±0.06%, βMyrcene: 3.62±0.04%, Cosmene: 0.32±0.04%, Limonene: 76.03±0.07%, delta-3 Carene: 3.87±0.03%, Thujone: 1.70±0.04%, Camphor: 0.39±0.06%, Isoborneol: Menthol: 0.23±0.05%, Isobornyl trace, acetate: 0.17±0.05%, b-Caryophyllene: 2.13±0.05%, Epi bicyclosesquiphellandrene: 0.34±0.06%,

Santalene: 5.84±0.04%,

Germacrene 0.16±0.04%,

α-Cariophyllene: 1.50±0.05%,

α D: β

Sesquiphellandrene: 0.35±0.02% and Germacrene B: 1.78±0.07%.[53]

Thirty-one components, eighteen hydrocarbons (91.99% of the total oil), two acetates (2.92%), three alcohols (3.59%), four ethers (0.49%), one aldehyde (0.05%), and three ketone (0.23%) were found in the essential oil composition of the Korean aerial section of Erigeron canadensis. The essential oil's main ingredients were delta-3-carene (15.9%) and D, L-limonene (68.25%).[54]

Table 1: Chemical compound and its composition [55]

Sr. No	Compound identified	% composition
1	αPinene	1.9
2	β Myrcene	1.2
3	pCymene	0.8
4	Limonene	57.2
5	(E) β Ocimene	1.1
6	β Pinene	2.1
7	Sabinene	0.8
8	pMenth1(7),8(10) dien9ol	0.3
9	Camphene	2.5
10	4Hexen3one 2,2 dimethyl	0.8
11	βCaryophyllene	6.7
12	Spathulenol	1.5
13	αCurcumene	3.0

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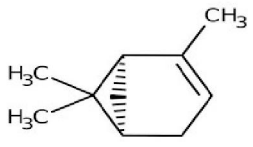
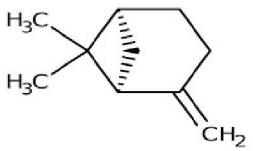
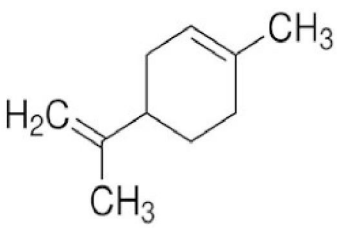
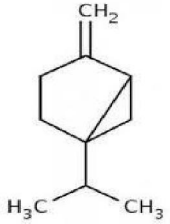
14	πMuurolene	1.1
15	Himachala1,4diene	0.7
16	2Allyl phenol	o.5
17	Un identified	0.2
18	2E,8ZMatricaria ester	0.2
19	Farnesene	0.8
20	βVatriene	0.9
21	δCadinene	0.7
22	Unidentified	0.8
23	Z,ZMatricaria ester	3.4
24	Unidentified	o.6
25	Germacrene D	4.9
26	2E,8Ematricaria ester	1.2



αPinene







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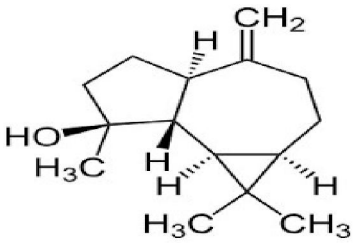
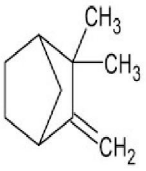


Camphene



Spathulenol

2.8 TRADITIONAL USES

Erigeron has been used as a natural pesticide to keep fleas away since the Roman era. Simply keeping it in the yard keeps mosquitoes away, but you can also rub the leaves on clothes or walkways to further deter ticks, gnats, flies, and mosquitoes. acris roots are applied topically to treat arthritis, bruises, and toothaches in Italian traditional medicine (56). Numerous traditional applications for Erigeron floribundas include treating rheumatism, gout, cystitis, nephritis, dysmenorrhea, tooth discomfort, head aches (57,58).

Fresh leaves are crushed into a paste and placed to the aching tooth as needed to relieve dental pain. 200 g of dried leaves are boiled in one litter of water to treat dysmenorrhea. After two hours of cooling and filtering, 100 cc of water is taken three times a day. Due of the plant's historical usage in treating inflammatory conditions including gout, cystitis, nephritis, and painful conditions like dysmenorrhea, rheumatic arthritis, it became valuable to test its anti-inflammatory and antinociceptive properties in mice and rats (59)

In mice, this herb has been shown to have anti-inflammatory properties. (60)

Cerebral infarction and peripheral circulation issues were treated with Erigeron brevis apus. (61)

2.9 PHARMACOLOGICAL ACTIVITIES

Erigeron Canadensis has a wide range of pharmacological properties such as including Anti-microbial, Anti-oxidant, Anticoagulant and Antiplatelet or Anti-inflammatory, Anti-cancer and Mutagenic activity

ANTIMICROBIAL ACTIVITY

Erigeron Canadensis's antibacterial activity was tested against eight harmful microorganisms, including Vibrio cholerae, Pseudomonas aeruginosa, Shigella flexneri, Shigella dysenteries, Bacillus subtilis, Micrococcus luteus, Staphylococcus aureus, and Escherichia coli. The ethanolic floral extract exhibited a low inhibition zone of 5 mm against B. subtilis and the greatest inhibition zone of 17 mm against P. aeruginosa. The flower's methanolic extract exhibited the lowest inhibition zone against M. luteus and the highest inhibition zone against E. coli. The plant's ethanolic and methanolic stem extracts showed no inhibitory zone.[62]

ANTIOXIDANT ACTIVITY

The crude methanolic extract and different solvent fractions (hexane, chloroform, ethyl acetate and butanol) were tested for antioxidant activity using DPPH free radical activity. The maximum antioxidant potentials at 100 µg/ml of ethyl acetate, aqueous fraction, n-hexane and chloroform fraction were 70.6, 71.65, 66.50 and 38.09 % with EC50 values of 50.35, 46.34 and 44.55 µg/ml respectively. [63] The antioxidant and protective effects of the plant extract were studied on plasma proteins against oxidative/nitrative damages induced by ONOO-.[64].

ANTICOAGULANT AND ANTI PLATELETS ACTIVITY

The phenolic-polysaccharide prepared from Erigeron canadensis showed in vivo anticoagulant activity, and the effect was neutralized by protamine sulfate. It had also anti-platelet activity, limited to the cyclooxygenase pathway, induced by arachidonic acid. [65]. The effects of various plant extract components were examined in vitro for platelet

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aggregation. Glycoconjugate, polysaccharide, and aglycon components of young or old plants, at concentrations greater than 0.75 mg/ml, significantly and dosedependently inhibited platelet aggregation induced by collagen (2 microg/ml).[66]

ANTI-INFLAMMATORY ACTIVITY

Erigeron canadensis (ECM) methanol extract's anti-inflammatory properties and underlying molecular processes were investigated in RAW264.7 macrophage cells were activated by LPS. Along these ECMinduced inhibitory effects, there were reductions in LPS-induced nuclear translocations together with
NFκB trans activities. [67]

ANTI-CANCER ACTIVITY

Extracts from the roots of Erigeron canadensis were more efficient than those from other organs, and the MCF7 cells were slightly more effective. The IC50 data showed that it was more sensitive than the other two cell lines. The maximum activity was shown by the n-hexane extracts of Erigeron canadensis roots. On the other hand, Erigeron canadensis showed a strong antiproliferative impact. [68-69]

MUTAGENIC ACTIVITY

Erigeron canadensis naturally occurring flavonoids were evaluated for mutagenicity using the Ames method on isolates of S. typhimurium TA1535, TA1538, TA97, TA98, TA100, and TA102 both with and without metabolic activation (both). In the Ames test, only quercetin and rhamnetin, two of the isolated flavonoids, demonstrated mutagenic activity. Point mutations were caused by quercetin in S. typhimurium strains TA97, TA98, TA100, and TA102. [70]

III. AIM & OBJECTIVES

Aim

Pharmacognostic and Phytochemical investigation of Erigeron canadensis

Objectives

- Collection of plant.
- Authentication of plant.
- Drying and storage of plant.
- Extraction of its phytoconstituents.
- Microscopic and Macroscopic investigation.
- Pharmacognostic evaluation of plant.
- Phytochemical screening.

IV. PLAN OF WORK

The objective of the study had been organized in a plan of work, which has been shown in Flow diagram

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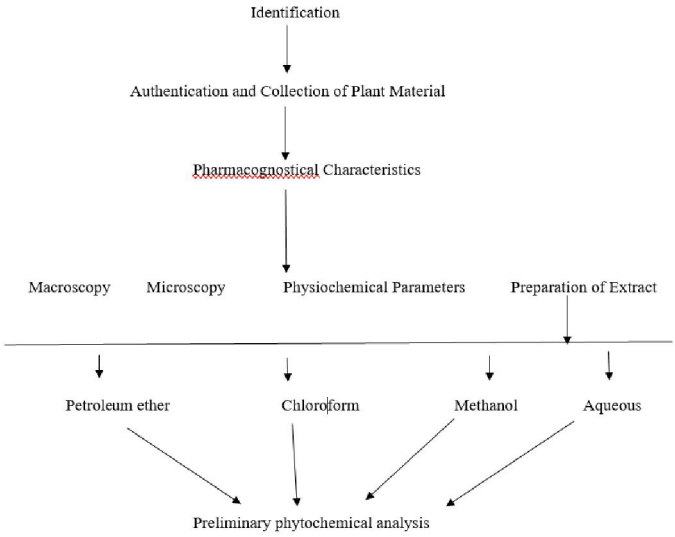

V. MATERIAL AND METHODS

• Collection and Identification of plant material: The plant material was collected fromoutside theAbhilashi university Distt.Mandi, Nerchowk.

• Drying and size reduction of plant: The plants were washed thoroughly with tap water and subjected to shade drying for about 5 weeks. The dried plant material was further crushed to powder mechanically and sieved and stored in air tight container for furthers analysis.

• Macro morphology of leaf: Fine hand sections of petiole and lamina of normal leaves weretaken. The organoleptic characters of fresh leaves and dried leaves powder like colour, odour, taste and macroscopic character like size,shape,surface,fracture were evaluated as per standard WHO guidelines. Morphology of leaf implies that the leaves are simple,petiolate, ovate and oblong. The colour, shape, margin and appearance are shown in (fig 1: Leaves of Erigeron canadensis).

• Microscopic features:

A. Transverse Section of Leaf: Fine hand sections of petiole and lamina and leaves were taken. The sections were double stained with safranin and fast green and mounted in glycerine. Epidermal peels were taken from fresh as well as fixed material of normal and infected leaves. Camera-lucida drawings were made from epidermal peels stained with delafields' haematoxylin and mounted in glycerine. The leaves were taken cleaned and fixed in formalin, acetic acid and ethanol. After 24 hours of fixing the specimens were dehydrated with graded series of tertiary butyl alcohol. The sections were stained with toluidine blue, safranin, fast green and iodine. Temporary preparations of the slide were made by mounting on glycerine.

b. Powder Microscopy: Shade dried leaf of the plant was powdered with the help of an electric grinder till a fine powder was obtained. This fine powder was subjected to powder microscopy using different staining reagents as mentioned above.

c. Fluorescence analysis: Many herbal drugs when exposed to illumination emit light of different colour. The fluorescence analysis helps to identify the drug with specific fluorescence. It also helps to detect fluorescent impurities. This method can be used as a diagnostic tool for testing adulteration.6 This method has been done by treating the leaf powder along with 1N HCl, 1 N NaOH, 50% HCl, 50% H2SO4, 50% HNO3 and Methanol was observed under the short UV light (254nm) and long UV light(365nm) (Madhavan et.al., 2009).

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• **Pharmacognostic Evaluation:** The dried leaves of Erigeron canadenis, were subjected for different standardization parameters for their purity and strength. Different parameters like Ash Value, Moisture content Loss on Drying has been performed according to WHO guideline, 1998.

a) Total Ash Value: It depicts the total amount of material produced after the complete incineration of the ground drug above 400 0C to remove all the carbon atom. 2g of powdered drugs was weighed and place in the crucible and heated at about 400 0C. The crucible was cooled and the % of the total ash with reference to the air- dried sample of the rude drug was calculated.

b) Acid Insoluble ash: Total ash was dissolved in dissolved in 1N HCl solution and heated for 5 min. The insoluble matter was filtered in Whatman filter paper; the filter paper was further dried at 70°C and then cooled. The residue was weighed and then the percentage of insoluble ash of the crude drug w.r.t. the air-dried sample of crude drug was calculated.

c) Water Soluble Ash: To the total ash crucible, 25 ml double distilled water was added and boiled for about 5 min. Insoluble matter was collected on an ash less filter paper in a crucible, washed with ho water and ignited for about 15min above 45°C. The weight of the residue is subjected from the weight of total ash. Content of water-soluble ash in mg/g of the air-dried material was calculated.

d) Determination of Solvent Extractive Value: 2g of the air-dried coarsely powdered drug was macerated with 100ml of different solvents in a closed flask for 24 hrs, and are shaken frequently. The solvent was filtered and the filtrate was weighed in a petri dish. The dish was evaporated on a water bath and then dried in an oven at 100°C. The dish was cooled and extractive value was calculated as %(w/w) with reference to air dried drug.

e) Loss on Drying (LOD): LOD is the loss in weight in %(w/w) resulting from water and volatile matter of any kind that can be driven off under specified conditions. 1g sample is transferred to a shallow bottle and weighed. Sample was distributed evenly and dried in a hot air oven a 105°C for 1hr with the stopper open. After 1hr, the stopper was closed and cooled at room temperature and the bottle was weighed.

f) Swelling Index: The Swelling Index is the volume in ml taken up by swelling of 1 gm of plant material under specific conditions. Swelling agent water as specified for individual plant material. Take 50 ml volumetric flask and add 25 ml water in it. Shake after 10 min. after 1 hr and stand for 3 hr. Measure the volume in ml occupied by the extract. It is done for hemicelluloses, pectin, mucilage.

g) Moisture Content: Moisture Content is excess of water in medicinal plants will encourage the microbial growth therefore it has to be controlled and therefore moisture content determination is an important parameter. In this method, drug is mixed with Xylene or Toluene & distilled. Water present in the drug get distilled out with the solvent. The total moisture content is calculated as- (WHO, Geneva, 1998) % Moisture Content = 100(n1-n)/w

• **Preparation ofPlant material and Extraction:**

Collected plant material (leaf and shoot) was first rinsed with running tap water and then double distilled water. The plant material that was free of dirt was dried at the ambient temperature. The powdered plant material was first obtained using an electrical grinder and then preserved in an air-tight container in a refrigerator set at 4°C. A process was carried out to extract plant material by working with four distinct solvents, namely methanol, water, chloroform and petroleum ether. 50 gm of the powdered plant material was used in the extraction procedure. They were put in the extraction chamber of a Soxhlet apparatus in a thimble made of Whatman filter paper (No. 1). The extraction was carried out using a 1:5 weight/volume ratio of extraction solvent to plant material. In the Soxhlet apparatus, 250 mL of extraction solvent was poured into the boiling flask, and a steady flow of freezing water was kept in the apparatus's condenser section. The heating mantle was used to maintain the temperature in the boiling flask. There was a cyclic flow of the extraction solvent between the boiling flask and the extraction chamber with the thimble in it. This cyclic flow was continually maintained for about 24-48 hrs. When the extraction procedure was finished the boiling flask holding the plant material and extraction solvent was taken out of the apparatus. The extract was then concentrated at 40°C.

• Preliminary Phytochemical Screening: All the extracts of Erigeron canadensis (L.) G. Don were subjected to qualitative tests for the identification of various active constituents by different chemical tests. The tests for

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Carbohydrates, Glycosides, Fixed oil and fat, Proteins & Amino acids, Saponins, Tannins, Alkaloid, Phenolic compounds and Flavonoids has been performed. (Qayoom et.al.,2009)

1. Test for Alkaloids:

a. Mayer's Test: To 2 ml test solution, 2N HCl was added. The aqueous layer was decanted and Mayer's reagent was added to it. A cream-coloured precipitate indicates the presence of alkaloids.

b. Dragendroff's Test: To 2 ml test solution, and Dragendroff's reagent was added to it. A reddish-brown precipitate indicates the presence of alkaloids.

c. Wagner's Test: To 2 ml test solution, and Wagner's reagent was added to it. A reddish-brown precipitate indicates the presence of alkaloids.

d. Hager's Test: To 2 ml test solution, and Hager's reagent was added to it. A yellow-coloured precipitate indicates the presence of alkaloids.

2. Test for Glycosides:

a. Fehling Test: To 2 ml test solution, equal quantity of Fehling solution A & B was added and solution was heated. A brick red precipitate indicates the presence of glycosides.

b. Legal's Test: To 2ml test solution, pyridine and alkaline sodium nitroprusside was added to obtain a blood red colour.

3. Test for flavanoids:

a. Shinoda Test: To 2 ml test solution, few fragments of magnesium ribbon were added and to it conc. H_2SO_4 was added drop wise. Pink scarlet or crimson red colour appears.

b. Zinc Chloride Reduction Test: To 2 ml test solution, a mixture of zinc dust and conc. HCl was added. A red colour is obtained after few minutes.

c. Alkaline Reagent Test: To 2 ml test solution, sodium hydroxide solution was added to give a yellow or red colour.

4. Tests for Tannins:

a. Gelatin Test: To 2 ml test solution, 1% Gelatin solution containing 10% sodium chloride was added to obtain a white precipitate.

b. Ferric Chloride Test: To 2 ml test solution, ferric chloride was added to give a blue green colour.

5. Test for Proteins and Amino Acids:

a. Millon's Test: To 2 ml test solution, Millon's reagent is added which gives a white precipitate, which on heating changes to red.

b. Ninhydrin Test: To 2 ml test solution, ninhydrin solution was added and the solution was boiled. Amino acids and proteins when boiled with 0.2% ninhydrin reagent show a violet colour.

6. Test for Fats and Fixed Oils:

Stain Test: Small amount of the extract was pressed between the filter paper, the stain on the filter paper indicates the presence of fixed oils.

7. Test for Saponins:

Saponification Test: Few drops of 0.5 N alcoholic potassium hydroxide were added in small quantity to the extract solution with a drop of phenolphthalein and heated on a water bath for 1-2 hrs. The formation of soap or partial neutralization for the alkali indicates the presence of Saponins.

8. Test for Sterols:

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Liebermann- Burchard Test: To the test solution, 3-4 drops of acetic anhydride was added, the solution was boiled cooled and conc. Sulphuric Acid (3 drops) was added. A brown ring appears at the junction of the two layers. The upper layer turns green showing the presence of steroids.

9. Test for Terpenoids:

Salkowski Test: To the test solution 2ml chloroform was added with few drops of conc.
Sulphuric acid (3ml) and shaken well. Appearance of reddish-brown colour at lower layer indicates the presence of steroids and that of yellow colour shows the presence of triterpenoids.

VI. CONCLUSION

According to this study, the genus Erigeron contains a wide range of chemical compounds, such as quercetin, spathulenol flavonoids, limonene, camphene, tannins, essential oils, and glycosides. When the composition and activity of several species of the Erigeron genus were investigated, it was found that they have a range of qualities, such as anti-inflammatory, antibacterial, antioxidant, and analgesic effects. The activity of Erigeron hybridus, Erigeron latus, and other species not on the above list has not been examined. Erigeron may offer improved traditional medicines or new chemicals to treat a variety of diseases. 96The current review discussed the phytochemical and pharmacological properties of Erigeron canadensis as a promising herbal therapy because of its effectiveness and safety.

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