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PHARMACOLOGICAL AND THERAPEUTIC IMPORTANCE OF *ERIGERON CANADENSIS* (SYN: *CONYZA CANADENSIS*)

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Abstract:

Phytochemical studies revealed that Erigeron canadensis (syn. Conyza canadensis) contained saponins, diterpenoids, terpenoids, glycosides, tannin, anthraquinone, steroids and flavonoids. Pharmacological studies showed that Erigeron canadensis exerted antimicrobial, antioxidant, anticoagulant, antiinflammatory, anticancer, mutagenic gastric protective effect and skin depigmentation activity. The current review discussed the phytochemical and pharmacological properties of Erigeron canadensis.

Keywords: *Erigeron canadensis, Conyza canadensis, contents, pharmacology*

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INTRODUCTION:

As a result of accumulated experience from the past generations, today, all the world's cultures have an extensive knowledge of herbal medicine. 75% of the world's population used plants for therapy and prevention. Plant showed wide range of pharmacological activities including antimicrobial, antioxidant, anticancer, hypolipidemic, cardiovascular, central nervous, respiratory, immunological, anti-inflammatory, analgesic antipyretic and many other pharmacological effects [2-30]. Phytochemical studies revealed that *Erigeron canadensis* (syn. *Conyza canadensis*) contained saponins, diterpenoids, terpenoids, glycosides, tannin, anthraquinone, steroids and flavonoids. Pharmacological studies showed that *Erigeron canadensis* exerted antimicrobial, antioxidant, anticoagulant, antiinflammatory, anticancer, mutagenic gastric protective effect and skin depigmentation activity. This review will highlight the phytochemical and pharmacological properties of *Erigeron canadensis*.

Synonyms:

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* [31].

Taxonomic classification:

Kingdom: Plantae, **Subkingdom**: Viridiplantae, **Infrakingdom**: Streptophyta, **Superdivision**: Embryophyta, **Division**: Tracheophyta, **Subdivision**: Spermatophytina, **Class**: Magnoliopsida, **Superorde**r: Asteranae, **Order**: Asterales, **Family**: Asteraceae, **Genus**: *Erigeron*/ *Conyza*, **Species**: *Erigeron canadensis* [32].

Common names:

Arabic: theil el-fars, hasheshat el-jabal, nashash el-theban, Asa kanada, sheikh al-rabi; **English**: butterweed**,** Canadian fleabane, Canadian horseweed, hogweed, horseweed; **French**: vergerette du Canada**; German**: kanadisches berufkraut; **Swedish:** kanadabinka [33].

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 [33].

Description:

Erigeron canadensis is a winter or summer annual forb. It is erect with one to several stems reaching 30 to 150 cm (1 to 5 ft) tall. Stems are typically unbranched at the base unless damage has occurred to the apical growing points. The leaves are linear to oblanceolate, 2 to 8 cm (0.8 to 3.1 in) long and 2 to 8 mm (0.08 to 0.31 in) wide. The leaf margins are ciliate-serrate. The inflorescence is a loose panicle. The numerous flower heads are very small, 2 to 4 mm (0.08 to 0.16 in) tall and 3 to 7 mm (0.12 to 0.28 in) wide. The rays are white or purplish and very small, only reaching 0.5 to 1.0 mm (0.02 to 0.04 in) in length. The fruit is an achene with a white bristly pappus [34-36].

Traditional uses:

The plant was used for the treatment of wounds, swellings, and pain caused by arthritis in Chinese folk medicine [37]. Zuni people insert the crushed flower of *Conyza canadensis* variety into the nostrils to crush sneezing and relieving rhinitis [38].

The leaves of *Erigeron canadensis* were prepared as tonic to be used in the treatment of diarrhea, diabetes and hemorrhages [39].

The plant was used in folk medicines in the northern areas of Pakistan for the treatment of various pathological conditions including acute pain, inflammation, fever and the microbial infections including urinary infections, respiratory tract infections, diarrhea and dysentery [40].

In Korea, the plant was used to treat allergic diarrhea, stomatitis, otitis media, conjunctivitis, and acute toothache [41].

The plant was also used as an antithelmintic, a mild hemostyptic, for uterine bleeding, gout, rheumatic symptoms, dropsy, tumors, and

bronchitis. In African folk medicine, it was used in the treatment of granuloma annulare, sore throats, urinary tract infections and for medicinal baths. In homeopathic medicine, *Erigeron canadensis* was used for bleeding of the bladder, hemorrhoids, menorrhagia and metrorrhagia, gastritis, hepatitis and cholecystitis [42].

Medicinal Parts:

The dried aerial parts of the plant and the fresh aerial parts of the flowering plant were used medicinally [42].

Chemical constituents:

Phytochemical studies revealed that *Erigeron canadensis* (syn. *Conyza canadensis*) contained saponins, diterpenoids, terpenoids, glycosides, tannin, anthraquinone, steroids and flavonoids. Conyzolide; conyzoflavone; conyzapyranone A; conyzapyranone B; 4 Z,8 Z-matricaria- γ-lactone; 4 E,8 Z-matricaria- γ-lactone ; 9,12,13-trihydroxy-10(E)-octadecenoic acid; epifriedelanol; friedeline; taraxerol; simiarenol; spinasterol; stigmasterol; β-sitosterol; C_{10} acetylenes; sesquiterpene hydrocarbons and many sphingolipids were isolated from different parts of the plant [40, 43-52].

Sphingolipids, 1,3,5-trihydroxy-2-hexadecanoyl amino-(6E,9E)-heptacosdiene; 1,3,5-trihydroxy-2-hexadecanoylamino-(6E,9E)-heptacosdiene-1-O-glucopyranoside; 1,3-dihydroxy-2-hexanoylamino-(4E)-heptadecene; p-hydroxybenzoic acid, 3,5-dihydroxybenzoic acid, 3,5-dimethoxybenzoic acid; 3beta-hydroxyolean-12-en-28-oic acid; 3beta-erythrodiol; beta-sitosterol; stigmasterol; beta-sitosterol 3-O-beta-D-glucoside and harmine were also isolated from the plant [51-52].

Eight sesquiterpenic hydrocarbons, beta-santalene, beta-himachalene, cuparene, alpha-curcumene, gamma-cadinene and three other unidentified hydrocarbons were isolated from the epigean part of the plant [49].

Twelve flavonoids were isolated from ethanolic extract of whole *Erigeron canadensis* and identified as quercetin-7-O-beta-D-galacto pyranoside,quercetin, luteolin, apigenin, 5,7,4'-trihydroxy-3'-methoxy flavone, quercetin-3-alpha-rhamnopyranoside, quercetin-3-O-beta-D-glucopyranoside, apigenin-7-O-beta-D-gluco pyranoside, luteolin-7-O-beta-D-glucuronide methyl ester,4'-hydroxy baicalein-7-O-beta-D-glucopyranoside, baicalein and rutin [53].

C-10 acetylene, namely 8R, 9R-dihydroxymatricarine methyl ester, triterpenoid, namely 3beta, 16beta, 20beta-trihydroxytaraxast-3-O-palmitoxyl ester, matricarine methyl ester, matricarine lactone, friedelin, friedelinol, β-sitosterol (7), α-spinasterol, 3- isopropenyl-6-oxoheptanoic acid, 9- hydroxy-10Z, 12E-octadecenoic acid, (+)-hydroxydihydroneo carvenol, 3', 4', 5, 7-tetrohydroxy dihydroflavone and 9, 12, 13-trihydroxy-10(Z)-octadecenoic acid were isolated from the whole *Erigeron canadensis*[54].

The compounds isolated from essential oils were differ among different locations which may be attributed to the different environmental and climatic conditions. A total of 23 components were identified in the essential oil of aerial parts of *Erigeron canadensis* from Ethiopial. The main constituents were monoterpenoids [limomene (57.2%), camphene (2.5%) α and β-pinenes (1.9 % and 2.1%)] and sesquiterpenoids [caryophyllene (6.7%), germacrene D (4.9%) and *α*-curcumene (3.0%)]. A few non-terpenoid acetylenic compounds (4.8%) were also detected. The isolated compounds were included: α-Pinene: 1.9%, β-Myrcene: 1.2%, p-Cymene: 0.8%, Limonene: 57.2%, (E) -β –Ocimene: 1.1%, β- Pinene: 2.1%, Sabinene: 0.8%, p-Menth-1(7),8(10) dien-9-ol: 0.3%, Camphene: 2.5, 4-Hexen-3-one 2,2 dimethyl: 0.8%, *β*-Caryophyllene: 6.7%, Spathulenol: 1.5%, *α*-Curcumene: 3.0%, π-Muurolene 1.1%, Himachala-1,4-diene: 0.7%, 2-Allyl phenol: 0.5%, *2E,8Z*-Matricaria ester: 0.2%, Farnesene: 0.8%, β-Vatriene: 0.9%, *δ*-Cadinene: 0.7%, Z,Z-Matricaria ester: 3.4%, Germacrene D: 4.9% and *2E,8E*-matricaria ester: 1.2% [55].

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%, β-Myrcene: 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: trace, Menthol: 0.23±0.05%, Isobornyl acetate: 0.17±0.05%, b-Caryophyllene: 2.13±0.05%, Epi-bicyclosesquiphellandrene: 0.34±0.06%, α-Santalene: 5.84±0.04%, Germacrene D: 0.16±0.04%,α-Cariophyllene: 1.50±0.05%, β-Sesquiphellandrene: 0.35±0.02% and Germacrene B: 1.78±0.07% [56].

The composition of essential oil from the aerial part of *Erigeron canadensis* from Korea showed thirty-one constituents, 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%). Major constituents of the essential oil were D,L-limonene (68.25% of the total oil) and delta-3-carene (15.9%) [57].

However, In studying the essential oils of *Erigeron canadensis* from Hungary, it appeared that the essential oil content of the roots of *Erigeron canadensis* was much lower (0.20%) than that of the herbs (0.72%). The essential oil of the herbs was found to be more complex than the oil of the roots. In the essential oil of the herbs, 34 components were detected while in the essential oil

of the roots, only 9 components were identified. The major constituent of the oil of the aerial parts was limonene (79.2%). Further compounds were mono- and sesquiterpenes in 8.6% and 6.6%, and acetylenes in 3.4%. The main component of the oil obtained from the roots was the acetylene compound, 2Z,8Z-matricaria ester (88.2 and 93.9% respectivel), and three other acetylenes (8Z-2,3-dihydromatricaria ester, 2E,8Z-matricaria ester, 4Z,8Z-matricaria lactone) were present in smaller amounts. However, the compounds identified in the essential oils of *Erigeron canadensis* herb were included: 2E-hexanal: 0.1%, α-pinene: 0.3%, Sabinene: trace, β-pinene: 2.8%, Myrcene: 1.5%, p-cymene: trace, limonene: 79.2%, trans-ocimene: 0.9%, 2,5-dimethyl styrene: 0.1%, E,E-cosmene: 0.4%, cis-verbenol: 0.5%, trans-sabinol: 0.4%, 2-allyl-phenol: 0.2, Myrtenol 0.3%: cis-p-mentha-1(7),8-dien-2-ol: 0.8%, trans-chrysanthenyl acetate: 0.3%, Modheph-2-ene: 0.1%, β-caryophyllene: 0.2%, α-trans-bergamotene: 2.9%, α-curcumene +amorpha-4,7(11)-diene: 1.8%, 11-αH-himachala-1,4-diene: 0.2%, 4E,8Z-matricaria lactone: 0.7%, δ-cadinene: 0.2%, 8Z-2,3-dihydromatricaria ester: 1.0%, 2E,8Z-matricaria ester: 0.3%, 2Z,8Z-matricaria ester: 2.1%, 4Z,8Z-matricaria lactone: trace, Germacrene B: 0.2%, Spathulenol: 0.3%, ar-turmerone: 0.1%, β-copaen-4-α-ol: 0.4% and Salvia-4(14)-en-1-one: 0.2% [46].

Pharmacological effects:

Antimicrobial effects:

The antibacterial activity of *Erigeron canadensis* was carried out against eight pathogenic bacteria (*Pseudomonas aeruginosa, Vibrio cholerae, Escherichia coli, Shigella dysenteriae, Shigella flexneri, Bacillus subtilis, Micrococcus luteus,* and *Staphylococcus aureus*). The ethanolic floral extract showed highest inhibition zone (17 mm) against *P. aeruginosa* and minimal inhibition zone against *B. subtilis* (5 mm). The methanolic extract of flower showed highest inhibition zone against *E. coli*, with lowest zone against *M. luteus.* No inhibition zone was noted by the ethanolic and methanolic stem extract of the plant [45].

The whole plant was extracted with 80% ethanol and the extract was suspended in water and fractionated with n-hexane, chloroform and ethyl acetate. Two isolated compounds (conyzolide and conyzoflavone) were studied for antifungal and antibacterial effects, against six fungal and five bacterial strains. Bacterial strains were *E. coli* ATCC 25922, *B. subtilis* ATCC 6633, *S. flexeneri* (clinical isolate), *S. aureus* ATCC 25923, *P. aeruginosa* ATCC 27853 and *S. typhi* ATCC 19430. Fungal strains included *T. longifusus* (clinical isolate), *C. albicans* ATCC 2091, *A. flavus* ATCC 32611, *F. solani* 11712 *and C. glaberata* ATCC 90030. The isolated compounds exhibited substantial antibacterial activities. Conyzolide showed comparatively better and significant antibacterial activities against *E. coli* (MIC: 25 µg/ml). It also revealed considerable activities against *S. aureus* (MIC: 50 µg/ml) *P. aeruginosa* (MIC:100 µg/ml) and *S. typhi* (MIC: 100 µg/ml). However, Conyzoflavone showed significant activity against S.*typhi* (MIC: 50µg/ml) in addition to its weak to moderate activity against all the tested pathogens. Similarly, both compounds exhibited significant antifungal activities against the tested fungi. Conyzoflavone also possessed antifungal activity, *T. longifusus* and *C. albicans* were the most susceptible fungal pathogens to conyzoflavone. On the other hand, conyzolide showed comparatively weak antifungal activity [40].

The crude methanolic extract of the plant and its various solvent fractions were evaluated for antibacterial effects (against *E. coli, P. aureginosa, Klebsella, S. aureus* and *Bacillus*) and antifungal effects (against *C. albicans, A. niger, M. canis, F. solani* and *C. glabarata*). The result showed that the tested samples were only effective against *E.coli*, *P. aureginosa, S. aureus*, while the remaining bacteria showed 100 % resistance. The methanolic extract, chloroform and ethyl acetate fraction demonstrated maximum activity with zone of inhibition 14, 12 and13 mm respectively while, the *n*-hexane fraction was devoid of antibacterial effect at low dose and exhibited low activity at high dose against *E. coli, P. aureginos and S. aureus* with zone of inhibition 10, 11 and 9 mm respectively. The maximum fungicidal effect against *C. albicans* was produced by ethyl acetate extract followed by chloroform and methanol extracts with percent inhibitory activity 45, 40 and 35 respectively. The ethyl acetate and chloroform fractions were the most effective against *A. niger* with percent inhibitory activity of 40 and 35% followed by methanolic extract and *n*-hexane with percent inhibitory effect of 30 and 25%. The maximum phytotoxic effect was produced by chloroform fraction followed by ethyl acetate (80 and 77%) [58].

The bacteriostatic and fungistatic activities of the oil of *Erigeron canadensis* were investigated by agar-diffusion method, against *Enterococcus faecalis* (ATCC29212), *Staphylococcus aureus* (ATCC25923) and *Streptococcus pyogenes* (HNCMB80002) as Gram-positive bacteria and *Escherichia coli* (ATCC25922), *Pseudomonas aeruginosa* (ATCC27853) as Gram-negative bacteria. Antifungal activity was evaluated against *Candida albicans* (UK-NEQUAS4661), *Candida glabrata* (ATCC90030), *Candida parapsilosis* (ATCC22019), *Candida tropicalis* (UK-NEQUAS4893), *Cryptococcus neoformans* (INF5855) reference fungal strains, and Candida kefyr, *Rhodotorula glutinis, Trichophyton*

interdigitalis and *Aspergillus fumigatus* fungal strains isolated from patients. None of the oils showed any activity against the tested bacterial strains, but exhibited moderate-to-strong activity against all fungi with the only exception of *A. fumigatus*. The MIC values varied from 1.25 µg/ml to 20.00 µg/ml for the tested fungal strains. The highest antifungal potency was exhibited by herb and root oils against *Cryptococcus neoformans* with MIC value of 1.25 µg/ml. In addition, substantial efficacy (MIC = 2.50 µg/ml) was detected against other Candida strains (*C. glabrata, C. tropicalis*) and *Rhodotorula glutinis* [46].

Essential oil of *Erigeron canadensis* at a concentration of 1600 ppm possessed 22.35±3.63, 12.71±1.28 and 29.27±1.22% inhibition of fungal growth of *R. solani, F. solani* and *C. lindemuthianum* respectively [56].

The methanol extract of aerial parts of *Erigeron canadensis* was extracted with four organic solvents (petroleum ether, chloroform, ethyl acetate and butanol) and investigated for antivirus activity against human cytomegalovirus (HCMV) AD-169 and Cox-B3 viruses by modified shell-vial assay. The results showed that chloroform, ethyl acetate, butanol and methanol extracts possessed antiviral activity, however, butanol extract antiviral activity was 95.75 and 90.10 % for 200 and 100 µg/ml of the extract respectively and methanol extract antiviral activity was 100 and 99.10% for 200 and 100 µg/ml of the extract respectively [59].

Antioxidant effects:

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 EC_{50} values of 50.35, 46.34 and 44.55 µg/ml respectively [43].

Treatment with 70% ethanolic extract of the aerial parts of *Erigeron canadensis* decreased NO production in a murine macrophage cell line (Raw 264.7) in a dose-dependent manner as follows: 25, 40 and 64% reductions, respectively, at the concentrations of 1, 10 and 100 mg/ml. In addition, no effect was possessed by te extract on the cell viability, but it showed potent DPPH radical scavenging activity [41].

The antioxidant and protective effects of the plant extract were studied on plasma proteins against oxidative/nitrative damages induced by $ONOO^-$. Peroxynitrite evoked oxidative stress and induced undesirable effects in biological systems and caused damage to biomolecules. The extract (50 – 2500 mg/ml) caused a dose-dependent reduction of protein nitration by 90%. The oxidation of plasma proteins was also diminished by about 75%. $ONOO^-$ oxidized the plasma thiol groups and this process was inhibited by tested extract. The level of reduced protein thiols was increased thrice at the lowest concentration of extract (50 mg/ml). The highest concentration of extract decreased twice the level of protein thiols in reduced forms and increased the homocysteine level about 4.5 times. Accordingly, extract possessed antioxidative properties *in vitro*, protected plasma proteins against toxicity induced by peroxynitrite and had modulating effects on thiol/disulfide redox status [60].

The protective effects of the polysaccharide extract from the plant on platelet proteins against nitrative and oxidative damage induced by $ONOO^-$ were studied . The extract of the plant distinctly reduced oxidation and nitration of proteins in blood platelets treated with $ONOO^-$ (0.1 mM) and O_2 production in these cells. The ability of the extract to decrease O_2 generation in blood platelets supported the importance of free radicals in platelet functions, including aggregation process [61].

Anticoagulant and anti-platelet effect:

The effects of different parts of extract of the plant on platelet aggregation *in vitro* were investigated. Aqueous extract of young or old plants, glycoconjugate part, polysaccharide part and aglycon part at the concentrations above 0.75 mg/ml strongly inhibited platelet aggregation induced by collagen (2 microg/ml) in a dose-dependent manner. Polysaccharide part isolated from plant extract had the strongest inhibitory effect on aggregation stimulated by collagen and seemed to be responsible for antiaggregatory properties of the plant [62].

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. The plant preparation was fractionated to determine the fraction of the highest anticoagulant activity. The influences of the plant preparation as well as its most active fraction on thrombin and factor Xa inactivation by antithrombin, and on thrombin inhibition by heparin cofactor II, were compared. Both inhibited thrombin as well as factor Xa amidolytic activities in the presence of antithrombin, but much higher concentrations were required to obtain the same effects for unfractionated heparin. The mechanisms of anticoagulant activity appeared to be based on interactions with heparin cofactor II, and inactivate of thrombin [63].

The protective effects of the polysaccharide extract from the plant on platelet proteins against nitrative and oxidative damage induced by $ONOO^-$ were studied. The oxidative damage of platelet

proteins induced by peroxynitrite and the protectory effects of this extract was evaluated by estimation of the level of carbonyl groups and nitrotyrosine (a marker of platelet protein nitration). The cytochrome c reduction method was used to test the ability of this extract to change O_2 generation in platelets. Moreover, the effects of the extract on blood platelet aggregation induced by ADP was also investigated. The extract of the plant distinctly reduced oxidation and nitration of proteins in blood platelets treated with $ONOO^-$ (0.1 mM), and O_2 production in these cells. The extract also inhibited platelet aggregation. The ability of the extract to decrease O_2 generation in blood platelets supports the importance of free radicals in platelet functions, including aggregation process [61].

Antiinflammatory effect:

The petroleum ether and ethanolic extract from the epigean part of the plant exhibited significant anti-inflammatory effect on rats with a carrageenin and formalin oedema. Eight sesquiterpenic hydrocarbons with the highest anti-inflammatory activity were found in the petroleum ether fraction (beta-santalene, beta-himachalene, cuparene, alpha-curcumene, gamma-cadinene and three other unidentified hydrocarbons) [49].

The anti-inflammatory activities and the underlying molecular mechanisms of the methanol extract from *Erigeron canadensis* (ECM) was studied in LPS-stimulated RAW264.7 macrophage cells. ECM significantly inhibited inducible nitric oxide synthase (iNOS)-derived NO and cyclooxygenase-2 (COX-2) derived PGE2 production in LPS-stimulated RAW264.7 macrophages. These inhibitory effects of ECM were accompanied by decreases in LPS-induced nuclear translocations and transactivities of NFκB. Moreover, phosphorylation of mitogen-activated protein kinase (MAPKs) including extracellular signal-related kinase (ERK1/2), p38, and c-jun N-terminal kinase (JNK) was significantly suppressed by ECM in LPS-stimulated RAW264.7 macrophages [64].

Anticancer effect:

Aqueous and organic extracts of 25 selected species from four tribes of Hungarian Asteraceae were screened *in vitro* for antiproliferative activity against HeLa (cervix epithelial adenocarcinoma), A431 (skin epidermoid carcinoma) and MCF7 (breast epithelial adenocarcinoma) cells, using the MTT assay. *Erigeron canadensis* extracts from the roots were more effective than those from other organs and the MCF7 cells were slightly more sensitive than the other two cell lines, as demonstrated by the IC_{50} values. The *n*-hexane extracts of the roots of *Erigeron canadensis* exhibited the highest activity. However, *Erigeron canadensis* demonstrated a substantial antiproliferative effect. Antiproliferative IC_{50} values were (HeLa 17.4-18.72 for herba and 6.47-12.94 for root, MCF7 7.93-15.8 for herba and 3.32-9.17 for root, A431 11.6-21.46 for herba and 9.47-20.12 for root, µg/ml), and cytotoxic activities (% ± SEM) (HeLa 68.37 ± 2.27- 71.09 ± 1.16 for herba and 85.76 ± 1.85- 95.28 ± 0.19 for root, MCF7 81.22 ± 1.79- 81.42 ± 0.72 for herba and 88.94 ± 0.64- 95.98 ± 0.57 for root, A431 59.00 ± 1.40- 72.55 ± 0.86 for berba and 86.99 ± 2.15- 98.06 ± 8.59 for root) [65-67].

The compounds isolated from the plant were evaluated for their antiproliferative activities. They were exerted considerable cell growth-inhibitory activity against human cervix adenocarcinoma (HeLa), skin carcinoma (A431), and breast adenocarcinoma (MCF-7) cells. Some of the active components, including conyzapyranone B; 4 E,8 Z-matricaria- γ-lactone and spinasterol, proved to be substantially more potent against these cell lines than against noncancerous human foetal fibroblasts (MRC-5) [44].

Studying of cytotoxicity of the plant essential oil showed that the IC_{50} value of the essential oil was 0.027 in MTT assay against HaCaT keratinocyte cell line [57].

Mutagenic effect:

The mutagenicity of naturally occurring flavonoids of *Erigeron canadensis* was tested by the Ames method with *S. typhimurium* strains TA1535, TA1538, TA97, TA98, TA100 and TA102 in the presence and absence of metabolic activation. Of the isolated flavonoids only quercetin and rhamnetin revealed mutagenic activity in the Ames test. Quercetin induced point mutations in strains TA97, TA98, TA100 and TA102 of *S. typhimurium*. The presence of S9 rat liver microsome fraction markedly enhanced the mutagenic activity of quercetin in these strains. Rhamnetin appeared to be a much weaker mutagen in the Ames test. The compound induced mutations in strains TA97, TA98 and TA100 of *S. typhimurium* but only in the presence of metabolic activation. Comparison of the structure of the studied flavonoids with their mutagenic activity indicated that the mutagenicity of flavonoids was dependent on the presence of hydroxyl groups in the 3' and 4' positions of the B ring, and the presence of a free hydroxy or methoxy group in the 7 position of the A ring also probably contributed to the appearance of mutagenic activity of flavonoids in the Ames test. It also appeared that the presence of methoxy groups, particularly in the B ring of the flavonoid molecule, markedly decreases the mutagenic activity of the compound [50].

Anti-gastric ulcer:

The 70% ethanolic extract of the aerial parts of *Erigeron canadensis* was found to protect against gastric ulcer induced by HCl/ethanol in mice. The administration of HCl/ethanol produced lesions on the gastric mucosa which were significantly and dose-dependently reduced from 74.4%, ulceration percentage to 14.4%, in the animals pretreated with % ethanolic extract of the aerial parts of *Erigeron canadensis* orally at the doses of 1 (54.6 - 10.2mm^2), 10 (21.6 - 6.4mm^2) and 100 mg/kg (10.6 - 4.5mm^2). In the group pretreated with extract at the dose of 100 mg/kg, the protective effect was higher than that of sucralfate used as a reference drug. Under histological evaluation, pre-treatment with extract reversed the alterations such as inflammation, edema, hemorrhage and a great loss of epithelium cells presented by HCl/ethanol treated stomachs, and the histological aspect was similar to those observed in normal stomach and the group treated with the reference drug [41].

De-pigmentation effect:

The effects of *Erigeron canadensis* extract were investigated on melanogenesis and cell toxicity in cultured B16F10 mouse melanoma cells. *Erigeron canadensis* extract down regulated melanin synthesis effectively at a non-toxic concentration. Its extract was fractionated into five fractions. One of the fractions showed melanin inhibition by 48.0% at 100 mg/ml which was 2.5 times more efficient than the depigmenting effect of commercial arbutin (17.5%) and also did not show cell toxicity. The *in vitro* and cellular tyrosinase activity, antioxidant activity, and protein level of the main melanogenic enzymes, such as tyrosinase, TRP-1 and TRP-2 were evaluated to elucidate the depigmenting mechanism of this fraction. The fraction inhibited melanin synthesis in B16F10 melanoma cells by decreasing protein levels of melanogenic enzymes, especially tyrosinase [68].

Side effects and contra-indications:

Health risks or side effects following the proper administration of designated therapeutic dosages were not recorded [42].

CONCLUSION:

The current review discussed the phytochemical and pharmacological properties of *Erigeron canadensis* as a promising herbal therapy because of its effectiveness and safety.

REFERENCES:

1.Davidson-Hunt I. Ecological ethnobotany: stumbling toward new practices and paradigms. MASA J 2000; 16: 1–13.
2.Al-Snafi AE. Pharmacology and toxicology of *Conium maculatum*- A review. The Pharmaceutical and Chemical Journal 2016; 3(2):136-142.
3.Al-Snafi AE. The constituents and pharmacology of *Cnicus benedictus*- A review. The Pharmaceutical and Chemical Journal 2016; 3(2):129-135.
4.Al-Snafi AE. Medicinal importance of *Colchicum candidum*- A review. The Pharmaceutical and Chemical Journal 2016; 3(2):111-117.
5.Al-Snafi AE. Nutritional value and pharmacological importance of citrus species grown in Iraq. IOSR Journal of Pharmacy 2016; 6(8): 76-108.
6.Al-Snafi AE. Chemical constituents and pharmacological effects of Dalbergia sissoo - A review. IOSR Journal of Pharmacy 2017; 7(2): 59-71.
7.Al-Snafi AE. Medical importance of *Datura fastuosa* (syn: *Datura metel*) and *Datura stramonium* - A review. IOSR Journal of Pharmacy 2017; 7(2):43-58.
8.Al-Snafi AE. A review on *Dodonaea viscosa*: A potential medicinal plant. IOSR Journal of Pharmacy 2017; 7(2): 10-21.
9.Al-Snafi AE. Medicinal plants with central nervous effects (part 2): plant based review. IOSR Journal of Pharmacy 2016; 6(8): 52-75.
10.Al-Snafi AE. Immunological effects of medicinal plants: A review (part 2). Immun Endoc & Metab Agents in Med Chem 2016; 16(2): 100-121. http://www.eurekaselect.com/146338
11.Al-Snafi AE. Medicinal plants affected male and female fertility (part 1)- A review. IOSR Journal of Pharmacy 2016; 6(10): 11-26.
12.Al-Snafi AE. Pharmacology and toxicology of *Conium maculatum*- A review. The Pharmaceutical and Chemical Journal 2016; 3(2):136-142.
13.Al-Snafi AE. The constituents and pharmacology of *Cnicus benedictus*- A review. The Pharmaceutical and Chemical Journal 2016; 3(2):129-135.
14.Al-Snafi AE. Medicinal importance of *Colchicum candidum*- A review. The Pharmaceutical and Chemical Journal 2016; 3(2):111-117.
15.Al-Snafi AE. Nutritional value and pharmacological importance of citrus species grown in Iraq. IOSR Journal of Pharmacy 2016; 6(8): 76-108.
16.Al-Snafi AE. The pharmacological and toxicological effects of *Coronilla varia* and *Coronilla scorpioides*: A review. The Pharmaceutical and Chemical Journal 2016; 3(2): 105-114. http://tpcj.org/download/vol-3-iss-3-2016/TPCJ2016-03-03-105-114.pdf
17.Al-Snafi AE. Pharmacological activities of *Cotoneaster racemiflorus*- A review. The Pharmaceutical and Chemical Journal 2016, 3(2):98-104. http://tpcj.org/download/vol-3-iss-3-2016/TPCJ2016-03-03-98-104.pdf
18.Al-Snafi AE. The constituents and pharmacology of *Corchorus aestuans*: A review. The Pharmaceutical and Chemical Journal 2016; 3(4):208-214. http://tpcj.org/download/vol-3-iss-4-2016/TPCJ2016-03-04-208-214.pdf
19.Al-Snafi AE. The chemical constituents and pharmacological activities of *Cymbopagon*

schoenanthus: A review. Chemistry Research Journal 2016; 1(5):53-61. http://chemrj.org/download/vol-1-iss-5-2016/chemrj-2016-01-05-53-61.pdf
20.Al-Snafi AE. Traditional uses, constituents and pharmacological effects of *Cuscuta planiflora*. The Pharmaceutical and Chemical Journal 2016; 3(4): 215-219.
21.Al-Snafi AE. A review on *Dodonaea viscosa*: A potential medicinal plant. IOSR Journal of Pharmacy 2017; 7(2): 10-21.
22.Al-Snafi AE. The pharmacology and medical importance of *Dolichos lablab* (*Lablab purpureus*)- A review. IOSR JOurnal of Pharmacy2017; 7(2): 22-30.
23.Al-Snafi AE. Pharmacological and therapeutic importance of *Desmostachya bipinnata*- A review. Indo Am J P Sci 2017; 4(01): 60-66.
24.Al-Snafi AE. Chemical constituents and pharmacological effects of *Eryngium creticum*- A review. Indo Am J P Sci 2017; 4(01): 67-73.
25.Al-Snafi AE. The pharmacology of Equisetum arvense- A review. IOSR Journal of Pharmacy 2017; 7(2): 31-42. http://www.iosrphr.org/papers/v7i2V1/D0702013142.pdf
26.Al-Snafi AE. A review on *Erodium cicutarium*: A potential medicinal plant. Indo Am J P Sci 2017; 4(01): 110-116.
27.Al-Snafi AE. Pharmacology of *Echinochloa crus-galli* - A review. Indo Am J P Sci 2017; 4(01): 117-122.
28.Al-Snafi AE. The pharmacological potential of *Dactyloctenium aegyptium*- A review. Indo Am J P Sci 2017; 4(01): 153-159.
29.Al-Snafi AE. Chemical constituents, pharmacological and therapeutic effects of *Eupatorium cannabinum*- A review. Indo Am J P Sci 2017; 4(01): 160-168.
30.Al-Snafi AE. Nutritional and therapeutic importance of Daucus carota- A review. IOSR Journal of Pharmacy 2017; 7(2): 72-88.
31.The plant list, a working list of all plant species, *Erigeron canadensis* http://www.theplantlist.org/tpl1.1/search?q=+Erigeron+canadensis
32.ITIS, *Conyza canadensis* (L.), http://www.itis.gov/servlet/SingleRpt/ SingleRpt?search_topic=TSN&search_value=37113
33.U.S. National Plant Germplasm System, *Erigeron canadensis*, https://npgsweb.ars-grin.gov/gringlobal/taxonomydetail.aspx?id=104213
34.Cronquist A, Holmgren AH, Holmgren NH, Reveal JL and Holmgren PK (eds). Intermountain flora: Vascular plants of the Intermountain West. Bronx, New York 1994; Vol 5: 496.
35.United States Department of Agriculture, Canadian horseweed, *Conyza canadensis* (L.) Cronquist, https://plants.usda.gov/plantguide/pdf/pg_coca5.pdf (Oct 2012).
36.USDA Natural Resources Conservation Service. The Plants Database. http://plants. usda.gov (Aug. 27, 2012).
37.Li TSC. Chinese and related North American herbs- Phytopharmacology and therapeutic values. New York, USA, CRC Press 2002.
38.Chevallier A. Encyclopedia of herbal medicine. DK Publications 1996: 276.
39.Sharma RK, Verma N, Jha KK, Singh NK and Kumar B. Phytochemistry, pharmacological activity, traditional and medicinal uses of Erigeron species: A review. International Journal of Advance Research and Innovation 2014; 2(2): 379-383.
40.Shakirullah M, Ahmad H, Shah MR, Ahmad I, Ishaq M, Khan N, Badshah A and Khan I. Antimicrobial activities of conyzolide and conyzoflavone from *Conyza canadensis*. Journal of Enzyme Inhibition and Medicinal Chemistry 2011; 26(4): 468–471.
41.Park WS, Bae JY, Chun MS, Chung HJ, Han SY and Ahn MJ. Suppression of gastric ulcer in mice by administration of *Erigeron canadensis* extract. Proceedings of the Nutrition Society 2013; 72: (OCE4), E263 doi:10.1017/S0029665113002887
42.PDR for herbal medicines, 3rd ed. Montvale, NJ. Thomson 2000: 144.
43.Shah NZ, Muhammad N, Azeem S and Rauf A. Studies on the chemical constituents and antioxidant profile of *Conyza canadensis*. Middle-East Journal of Medicinal Plants Research 2012; 1(2): 32-35.
44.Csupor-Löffler B, Hajdú Z, Zupkó I, Molnár J, Forgo P, Vasas A, Kele Z and Hohmann J. Antiproliferative constituents of the roots of *Conyza canadensis*. Planta Medica 2011; 77(11): 1183–1188.
45.Biswas K and Sinha SN. Evaluation of antibacterial activity of *Conyza canadensis* (L.) Cronquist collected from Nainital, Uttarakhand, India. International Journal of Universal Pharmacy and Bio Sciences 2014; 3(1): 46-53.
46.Veres K, Csupor-Löffler B, Lázár a and Hohmann J. Antifungal activity and composition of essential oils of *Conyza canadensis* herbs and roots. Scientific World Journal 2012; doi: 10.1100/2012/489646
47.Bohlmann F and Jakupovic J. 8-Oxo-α-selinen und neue scopoletin-derivate aus Conyza-arten. Phytochemistry 1979; 18(8): 1367–1370.
48.Wei DX, Gao X and Zhong JJ. A new C-10 acetylene and a new triterpenoid from *Conyza canadensis*. Archives of Pharmacal Research 2007; 30(5): 547–551.
49.Lenfeld J, Motl O and Trka A. Anti-inflammatory activity of extracts from *Conyza canadensis*. Pharmazie 1986; 41(4): 268–269.
50.Czeczot H, Tudek B, Kusztelak J, Szymczyk T, Dobrowolska B, Glinkowska G, Malinowski J and Strzelecka H. Isolation and studies of the mutagenic activity in the Ames test of flavonoids naturally occurring in medical herbs. Mutation Research 1990; 240(3): 209–216.
51.Mukhtar N, Iqbal K, Anis I and Malik A. Sphingolipids from *Conyza canadensis*. Phytochemistry 2002; 61(8):1005–1008.

52.Mukhtar N, Iqbal K and Malik A. Novel sphingolipids from *Conyza canadensis*. Chemical and Pharmaceutical Bulletin 2002; 50(12): 1558–1560.
53.Shao S, Yang MM, Bi SN and Wan ZQ. Flavonoids of *Erigeron canadensis*. Zhongguo Zhong Yao Za Zhi 2012;37(19):2902-2905.
54.Xie WD, Gao X and Jia ZJ. A new C-10 acetylene and a new triterpenoid from *Conyza canadensis*. Arch Pharm Res 2007; 30(5): 547-551.
55.Unnithan CR, Muuz M, Woldu A, Reddy DN, Gebremariam G and Menasbo B. Chemical analysis of the essential oil of *Erigeron canadensis* L. UJPBS 2014; 2(2): 8-10.
56.Curini M, Bianchi A, Epifano F and Bruni R. Composition and *in vitro* antifungal activity of essential oils of *Erigeron canadensis* and *Myrtus communis* from France. Chemistry of Natural Compounds 2003; 39(2) : 191-194.
57.Choi HJ. Composition and cytotoxicity of essential oil extracted by steam distillation from horseweed (*Erigeron canadensis* L.) in Korea. Journal of The Korean Agricultural Chemical Society 2008; 5(1): 55-59.
58.Shah NZ, Khan MA, Muhammad N and Azeem S. Antimicrobial and phytotoxic study of *Conyza canadensis*. Middle-East Journal of Medicinal Plants Research 2012; 1(3): 63-67.
59.Edziri1 HL, Laurent G, Mahjoub A and Mastouri M. Antiviral activity of *Conyza canadensis* (L.) Cronquist extracts grown in Tunisia. African Journal of Biotechnology 2011; 10(45): 9097-9100.
60.Saluk-Juszczak J, Olas B, Nowak P, Wachowicz B, Bald E, Głowacki R, Pawlaczyk I and Gancarz R. Extract from *Conyza canadensis* as a modulator of plasma protein oxidation induced by peroxynitrite *in vitro*. Cent Eur J Biol 2010; 5(6): 800-807.
61.Olas B, Saluk-Juszczak J and Pawlaczyk I. Antioxidant and antiaggregatory effects of an extract from *Conyza canadensis* on blood platelets in vitro. Platelets 2006; 17(6): 354-360.
62.Saluk-Juszczak J, Olas B, Pawlaczyk , Gancarz R, Wachowicz B. Effects of the extract from *Conyza canadensis* on human blood platelet aggregation. Gen Physiol Biophys. 2007 Jun;26(2):150-152.
63.Pawlaczyk I, Czerchawski L, Kuliczkowski W, Karolko B, Pilecki W, Witkiewicz W and Gancarz R. Anticoagulant and anti-platelet activity of polyphenolic-polysaccharide preparation isolated from the medicinal plant *Erigeron canadensis* L. Thrombosis Research 2011; 127(4): 328-340.
64.Sung J, Sung M, Kim Y, Ham H, Jeong HS and Lee J. Anti-inflammatory effect of methanol extract from *Erigeron canadensis* L. may be involved with upregulation of heme oxygenase-1 expression and suppression of NF κ B and MAPKs activation in macrophages. Nutr Res Pract 2014; 8(4):352-359.
65.Réthy B. Antitumor effect of plant extracts and their constituents on cancer cell lines. PhD thesis, Department of Pharmacodynamics and Biopharmacy, Faculty of Pharmacy, University of Szeged 2007.
66.Réthy B, Csupor-Löffler B, Zupkó I, Hajdú Z, Máthé I, Hohmann J, Rédei T and Falkay G. Antiproliferative activity of Hungarian asteraceae species against human cancer cell lines. Part I. Phytother Res 2007; 21(12): 1200-1208.
67.Csupor-Löffler B, Hajdú Z, Réthy B, Zupkó I, Máthé I, Rédei T, Falkay G and Hohmann J. Antiproliferative activity of Hungarian asteraceae species against human cancer cell lines. Part II. Phytother Res 2009; 23(8):1109-1115.
68.Hong ES, Nguyen DTM, Nguyen D and Kim EK. Inhibition of melanogenesis by *Erigeron canadensis* via down-regulating melanogenic enzymes in B16F10 melanoma cells. Korean Journal of Chemical Engineering 2008; 25(6): 1463-1466.