REVIEW

A Review on Pharmacological Significance of Genus Jatropha (Euphorbiaceae)

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ABSTRACT A number of herbs belonging to the genus Jatropha of Euphorbiaceae family are noted for their medicinal benefits. The genus Jatropha is one of the prospective biodiesel yielding crops. The plants which have been so far explored include J. curcas, J. gossypifolia, J. glandulifera, J. multifida and J. podagrica. Although, the plants of this genus are widely distributed, there is an exigency of scientific literature proclaiming the medicinal benefits of the plants belonging to genus Jatropha. The present paper is a pragmatic approach to accrue the findings on this very significant genus.

KEYWORDS Jatropha, Euphorbiaceae, pharmacological activity

Jatropha (Euphorbiaceae) is a genus of approximately 175 succulent plants, shrubs and trees (some are deciduous like Jatropha curcas L.). Irrespective of the species, extracts from different parts such as leaves, stem, bark and roots of the Jatropha plant have been used in ethno-medicines for a long time. In the past two decades, study on the utilization of Jatropha oil (non edible) as a feedstock for biofuel has gained a momentum, resulting in industrial scale cultivation. Apart from the seed oil, genus Jatropha is also a rich source of phytochemicals that can be utilized in agricultural, nutritional and pharmaceutical industries.

Plants of the genus Jatropha are herbs, shrubs or trees, monoecious (rarely dioecious), exudate is watery to white; possess poisonous substance in the sap/seed. Leaves alternate, often digitately lobed, indumentum has simple hairs and sometimes glandular hairs; Flowers are terminal cymes with single pistillate flower at the end of primary axis. Sepals are 5 in number, imbricate, free; petals – 5, mainly free; staminate disc annular or 5 free glands, stamens 6–10, in two whorls; pistillate foliaceous annular, 5-lobed; fruits capsular to tardily dehiscent and sub-drupaceous.

BIOLOGICAL ACTIVITY

Analgesic Activity

The methanolic extracts of J. unicostata leaves and fruits were tested at a dose of 200 and 400 mg/kg in acetic acid-induced abdominal writhing and hot plate test model in mice. The abdominal constriction by acetic acid showed inhibition (17% and 41%). The antinociceptive activity was the highest at 90 min reaction time in a hot plate test model. Ethanol and water extracts of J. curcas bark and leaves were analysed for analgesic activity using Eddy’s hot plate method. Ethanolic and aqueous leaf extracts at a dose of 300 mg/kg intraperitoneally (i.p.) in mice exhibited maximum activity at 120 min. Ethanol/water (1:1) extract of the aerial parts, administered to mice at a dose of 0.25 mg/kg (i.p.) was inactive in tail pressure method. The methanolic extract of J. curcas leaves, at doses ranging from 10 to 80 mg/mL in mice, using acetic acid induced writhing model, exhibited significant analgesic activity comparable to paracetamol.

Anthelmintic Activity

Aqueous and hydro-alcoholic extracts of J. curcas seeds exhibited poor activity on the survival of adult parasites Haemonchus contortus, but induced good egg-hatching-inhibition with 50% effective dose (ED50) 0.1 and 0.23 mg/mL. 50 mg/mL hexane, ethyl acetate and ethanol extracts of J. curcas seeds inhibited egg-hatching by 15.3%, 32.2% and 99.8%, respectively in Haemonchus contortus.

Anticancer Activity

Calenduladiol and (3β,16β)-16-hydroxy-lup-20-(29)-en-3-yl (E)-3-(4-hydroxyphenyl)prop-2-enoate
isolated from dichloromethane/methanol extract of J. neopaciflora bark exhibited cytotoxic activity against human tumour cell lines of leukemia (K562, CML) and central nervous system (U251, Glia).\(^{10}\) Jatropham, jatrophatrine and acetylaceutelic acid isolated from J. macrocarhoza roots exhibited inhibitory activity towards the P-388 (3PS) lymphocytic leukemia test system. \(^{(11,12,13)}\) 25 \(\mu\)g/mL of J. curcas root methanol extract decreased the human colorectal adenocarcinoma (HT-29) cell viability to 28.8% while the Chang liver cell viability was 72.4%. The IC\(_{50}\) concentration for HT-29 and Chang liver cell lines were 18.3 and 33.3 \(\mu\)g/mL. The leaf and stem extracts were found to be less potent.\(^{(11-14)}\)

Curcin, isolated from seeds of J. curcas, had a powerful inhibitory action upon protein synthesis in reticulocyte lysate with an 50% inhibitory concentration (IC\(_{50}\)) value of 0.19 nmol/L. The IC\(_{50}\) of curcin on gastric cancer cell line (SGC-7901), mouse myeloma cell line (Sp2/0) and human hepatoma was 0.23, 0.66 and 3.16 mg/mL, respectively. Curcin was found to be non toxic to carcinoma cell line (Hela cells) and human embryo lung diploid cell line (normal cells, MRC).\(^{(15)}\) Methanol extract of J. curcas leaves failed to produce antitumour activity against breast cancer, leukemia, non small cell lung cancer, colon cancer, central nervous system (CNS) cancer, melanoma, ovarian cancer and renal cancer cell lines.\(^{(16)}\) Dichloromethane extract of J. gaumeri roots exhibited cytotoxic activity against human nasopharynx carcinoma with ED\(_{50}\) 7.8 \(\mu\)g/mL.\(^{(17)}\)

**Diterpene jatrophone derivatives**, 2 \(\alpha\)-hydroxyjatrophone, 2 \(\beta\)-hydroxyjatrophone and 2 \(\beta\)-hydroxy-5, 6-isojatrophone, isolated from roots of J. gossypifolia were evaluated for their antineoplastic activity in the P-388 lymphocytic leukemia test system both in vitro and in vivo, as well as for the Eagle’s carcinoma of nasopharynx test system (KB) in vitro. 2 \(\alpha\)-hydroxyjatrophone and 2 \(\beta\)-hydroxyjatrophone were found to be less active than jatrophone and 2 \(\beta\)-hydroxy-5, 6-isojatrophone was substantially less cytotoxic in KB and P-388 in vitro test system but inactive in P-388 in vivo system.\(^{(18)}\) Pure diterpenoids isolated from J. curcas, curcuseone C, curcuseone D, multidione, 15-epi-4Z-jatrogrossidentadion, 4E-jatrogrossidentadion, 4Z-jatrogrossidentadion, 2-hydroxyjatrogroosidion and 2-epi-hydroxyisojatrogrossidion showed strong cytotoxicity against L5178y mouse lymphoma cells and HeLa human cervix carcinoma cells, while they caused none or only very low activity against neuronal cell PC12.\(^{(19)}\)

Chloroform and ethanol extracts of J. curcas leaves and twigs, in cell culture as well as in mice (i.p.), were active on leukemia cell line LEUK-P388 but inactive on carcinoma cell line CA-9KB, while petroleum ether extracts were inactive in all cases.\(^{(20)}\) Ethanol extract of defatted seeds of J. curcas, in cell culture, was active on leukemia cell line LEUK-P388 having ED\(_{50}\) 9.0 \(\mu\)g/mL.\(^{(21)}\) Ethanol extract of defatted seeds of J. curcas, administered intraperitoneally to mice, was inactive on leukemia cell line LEUK-P388 and carcinoma cell line CA-9KB with ED\(_{50}\) > 30.0 \(\mu\)g/mL.\(^{(22)}\) Ethanol/water (1:1) extract of J. curcas aerial parts, in cell culture, was active against carcinoma cell line CA-9KB with ED\(_{50}\) < 20.0 \(\mu\)g/mL.\(^{(23)}\)

The ethyl acetate fraction of methanolic extract of J. curcas aerial parts inhibited the Agrobacterium tumefaciens induced tumor formation in potato disc by 82% at a concentration of 3.0 \(\mu\)g/mL (EC\(_{50}\)= 1.43 \(\mu\)g/mL) while aqueous fraction was inactive. Ethyl acetate fraction of methanolic extract of J. weberbaueri bark inhibited the tumour formation by 83% at a concentration of 3.0 \(\mu\)g/mL (EC\(_{50}\)=1.52 \(\mu\)g/mL) while aqueous fractions of methanolic extracts of leaf, bark and ethyl acetate fraction of leaf were inactive. Both ethyl acetate and aqueous fractions of methanolic extract of J. gossypifolia aerial parts were found to be inactive.\(^{(24)}\) Ethanol extract of J. tanjorensis leaves showed moderate cytotoxicity against normal vero cell lines (C-1008 kidney fibroblasts, IC\(_{50}\) vero=1.8 ± 0.42 \(\mu\)g/mL) while aqueous and hydro-ethanolic (50:50) extracts were inactive.\(^{(25)}\)

Methanolic fraction of J. curcas leaf methanol extract administered orally at doses of 100 and 200 mg/kg significantly inhibited metastatic colony formation of lung melanoma cells B16F10 in C57BL/6 mice by 47.54% and 69.52%, respectively.\(^{(26)}\) Jatrophane, isolated from rhizomes of J. isabelli, displayed cytotoxicity against fibroblast cell line, MRC-5 (IC\(_{50}\) 2.8 \(\mu\) mol/L) and human epithelial gastric cell line (IC\(_{50}\) 2.5 \(\mu\) mol/L).\(^{(27)}\)

**Anticonvulsant Activity**

Ethanol/water (1:1) extract of J. curcas aerial parts, at a dose of 0.25 mg/kg (i.p.), was found to be inactive.