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Review

Chemotherapeutic and economic potentials of some laticiferous plants

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Information on medicinal properties of plants used in traditional medicine is very complex and the literature review is scattered and diverse. It covers data on the plants concerned, their chemical constituents, ethnobotanical and toxico-pharmacological information. The objective of this review is to identify the various laticiferous plants, their medicinal uses and toxicity.

Key words: Laticiferous plants, medicinal uses, toxicity.

INTRODUCTION

Varying amount of latex, a milky juice, are found in species of many plant families including Aceraceae, Apocynaceae, Asclepidaceae, Bognoniaceae, Cricaceae, Clusiaceae, Euphorbiaceae, Fabaceae, Leguminaceae, Liliaceae, Mimosaceae, Moraceae, Oxilidaceae, Papaveraceae, Papilionaceae, Piperaceae, Sapotaceae and Solanaceae. The role of latex is not known with certainty. It has been suggested that latex is closely associated with isoprene which may be emitted as gas from plants that may or may not contain latex, and animals. The role of isoprene expelled into the air is approximately equal to that of total methane emission. Hunter (1994) described the roles of latex and isoprene in defense mechanism against insect pests, carbon sinks, stores of food and water and anti-dote to ozone toxicity.

MEDICINAL USES AND TOXICITY OF LATICIFEROUS PLANTS

The plant family, Euphorbiaceae, parades a long list of medicinal and poisonous plants. The name Euphorbia is considered by the natives of South Africa as synonymous to poison. The latex of a considerable numbers of species of the genus Euphorbia is used as an ingredient of arrow poisons and it yields a crystallizable principle, euphorbon, which is not regarded as the cause of irritant action (Watt and Breyer-Brandwijik, 1962). The same authors suggested that the irritant principle may be phytotoxin with haemaglutinizing properties and that the toxic principle is a resin which gives a reddish-purple colour with concentrated sulphuric acid containing a trace of nitric acid.

Euphorbia cadelbrum and *Euphorbia cooperi* latex is used as an arrow and fish poison and causes irritation of the eye, with a potential to cause blindness (Watt and Breyer-Brandwijik, 1962). Application of the latex to the face or tender skin produces a blister within a short period and the phorbol ester isolated from methanol extract of *E. cooperi* exhibits highly irritant actions on the ear of the mouse and may be associated with possible tumor development (Gundidza et al., 1992).

The leaves and latex of *Euphorbia heterophylla*, known in Sudan as umlibina, are poisonous. The latex is acrid and it produces emesis, purging and delirium before death (Karalai et al., 1994). *Euphorbia nematocypha* latex is used in China to treat ulcers and tumors, although the plant latex is known to be extremely toxic causing severe dermatitis. Phytochemical screening has shown that the plant latex contains 3-0-(2,4,6,8-tetradecatetraene-1) ingenol and 3-0-(2,4,6,8,-pentadecatetraenoyl) ingenol (Dagang et al., 1992). *Euphorbia metablensis* Pax latex contains skin irritant,

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carcinogenic principles and other unknown toxic constituents which cause health hazards to both man and grazing livestock. A diterpene of the igenane-type parent alcohol with tetradecanoic acid was isolated by chromatographic methods from the latex of *E. metablensis* (Gundidza et al., 1993). These authors commented that the ingenol ester exhibited irritant action on mouse ear and that the use of the latex for medicinal purposes was not recommended.

The aqueous solution from the latex of *Euphorbia splendens* causes irritation to the rabbit eye in concentration higher than 0.35% and to rabbit skin in concentration higher than 0.5% (Freitas et al., 1991). *Euphorbia lathyris*, the Caper spurge plant seeds, are of particular interest in Africa because of their high oleic acid content (Hecker and Sosath, 1989).

Euphorbia retusa is known in Saudi Arabia as Ghazalah and the aerial parts of the plant containing latex is used for the treatment of neuralgia, cough and asthma. The plant was found to contain alkaloids, flavonoids, tannins, triterpenes, sterols and thirteen deoxyphorbol esters having skin irritant properties (Saleh, 1985; Ageel et al., 1985). Mild sedation, accompanied by slow and shallow respiration, hypothermia and neuromuscular blocking effect was produced in mice and rats by intraperitoneal administration of ethanolic extract of the plant at 500 mg/kg (Tarig et al., 1984). *Euphorbia cyparissiodes* is used for the treatment of snake bite, cough, warts, other skin diseases and asthma (Evans et al., 1975; Baslas, 1981).

Euphorbia abyssinica is known in Sudan as Zakoom or Shager El-Sim. Watt and Breyer-Brandwijik (1962) indicated that the plant latex contains euphorboresin, euphorbon and unknown fatty principle. They also reported that Rhodesians apply the latex to wounds, sores and ringworm lesions as well as for homicidal purposes.

Calotropis procera (Sodom's apple) (Asclepiadaceae), commonly called Ushar (Sudan), contains latex extracts used for milk coagulation in cheese-making and as fuel and energy and for treatment of various diseases. Two proteins were isolated from the plant latex, purified and found to degrade casein (Aworth et al., 1994). The ethanol extract of *C. procera* latex yielded two compounds which were identified as tetraxasteryl acetate and triterpenes, taraxcast (Radha-pant et al., 1989). The latex, flowers, and root bark of this plant are used in Indian folk medicine, mainly for the treatment of digestive system disorders, asthma, cough, catarrhal inflammation of the upper respiratory tract and skin diseases (Khan and Abdul-Malik, 1989).

Monadenium lugardiae (Euphorbiaceae) is commonly used in traditional medicine in Zimbabwe in its diluted or undiluted state. Oral administration of 0.1 or 0.01% of the latex was not fatal to 3-month-old albino rats, but caused severe diarrhoea (Gundidza, 1993). *Xanthium spinosum* (Asteraceae) commonly called Mashouk in the Sudan and neighboring countries, exudes latex which contains much formic acid that confers it with anti-septic properties. The latex is also reported to contain two sesquiterpenes, lactones, xanthathin, xanthanin, cardiac glycosides, flavonoids and tannins (Metwally et al., 1974; Omar et al., 1984). One thousand parts per million (1000 ppm) of ethanol and chloroform extracts of the latex caused death of brime shrimps (Al-Yahya et al., 1990).

Ficus elastica is a member of the family Moraceae and is locally known as Labakh. There are twenty four species in the genus Ficus which are indigenous to South Africa and the fruit of most of them is edible although not so palatable as *Ficus carica* (Watt and Breyer-Brandwijk, 1962). *Withania somnifera* (Solanaceae) is locally known as Sum El Far or Sum el firakh and is medicinally used as aphrodisiac, tonic, anthelmintic and narcotic by traditional medicine practitioners. It is also described as an adaptogen which enhances survival during stress (Singh et al., 1982). Withaferin, withanolides, steroidal lactones, withasmine, pyrazole alkaloid, visamine, tropine, volatile bases and volatile oil were isolated by many investigators (Covello and Ciampa, 1960; Khanna et al., 1961; Schroter et al., 1966; Abraham et al., 1975). Information on the plant toxicity in animals is lacking.

Anti-microbial activity of laticiferous plants

Many laticiferous plants were found to possess anti-microbial activity. For example, the latex of *Ipomoea fisulosa* (Convolvulaceae) is used in folk medicine as anti-septic and the chloroform extracts of the latex, stem and flowers of the plant have been investigated for their activity against 7 Gram-positive bacteria, 13 Gram-negative bacteria and 8 fungi, using the disc diffusion method and found to possess a potent anti-bacterial activity against Shigella and Bacillus species with no anti-fungal activity (Reza et al., 1994).

During anti-fungal testing of the latex of 20 plants spp. against ringworm fungi, *Microsporum gypsem* and *Trichophyton mentagrophytes*, only the latex of *Croton banplandianus* exhibited absolute toxicity inhibiting the mycelial growth of both fungi (Asthana et al., 1989). The same author indicated that the latex of *Argemone mexicana* (Papaveraceae) was active against *T. mentagrophytes* while that of *Jatropha panduraefolia* (Euphorbiaceae) was effective against *M. gypseum* and that maximum dilution of Croton latex for absolute inhibition of *M. gypseum* and *T. mentagrophytes* was 1:10 and 1:15, respectively.

Antihelmintic activity of laticiferous plants

F. carica (Moraceae) latex is used as an antihelmintic and for the coagulation of milk (Wasim and Abdulmalik 1994); De Morina et al. (1999) examined *Ficus insipida* and *F. carica* latex for their anthelmintic activity against

Syphacia obvelata, Aspiculuris tetraptera and *Vamirolepis nana* and they found high acute toxicity and week antihelminitic efficacy. The latex of *Carica papaya* (Caricaceae) was tested for antihelmintic activity against natural infection of *Ascaris suum* in pigs at 2, 4 and 8 g/kg body weight and was found to reduce worm burden at 39.5, 80.1 and 100% respectively (Satrija et al., 1994).

Trypanocidal and leishmanicidal activities of laticiferous plants

The stem, leaves, flowers, stem bark, latex and/or whole plant extracts of *Jatropha cuspidifolia* (Euphorbiaceae), *Acacia* spp. (Leguminosaea), *Oxalis* spp. (Oxalidaceae) and *Piper elongate* (Piperaceae) were found effective against cutaneous leishmaniasis caused by *Leishmania amazonensis, Leishmania braziliensis* and *Leishmania donovani*, and against *Tryapanosoma cruzi* infection (Fournet et al., 1994).

Analgesic, sedative and anti-pyretic activities of laticiferous plants

The latex of *Garina cowa* (Clusiaceae) is used in Thai folk medicine as anti-fever agent. The latex was also reported to contain five xanthones, cowanin, cowanol, cowaxcanthone, xanthone and norocowanin as phytoconstituents which were found to have anti-bacterial activity against *Staphylococcus aureus* (Pattalung et al., 1994).

Pharmacological studies conducted on mice with sesquiterpene lactones, lactucin and jacquinelin of L*actuca virosa* (Asteraceae) and with plant preparations P-I (a freeze-dried aqueous extract of the aerial parts of the plant) and P-3 (a glycosidic fraction of the plant) showed that P-I, P-3 and lactucin possess sedative and analgesic properties (Gromek et al., 1992).

Molluscicidal activity of laticiferous plants

Molluscicidal activity of aqueous extracts of the latex of *Euphorbia splendens* was reported to be irritant to the eyes and skin of rabbit at concentrations higher than 0.35% and was effective molluscicide against schistosomiais vector (Freitas et al., 1991).

Allergy-inhibiting activity of laticiferous plants

The latex of *Dyera costulata* (Jaeluteng) and *Dyera lowii* was found to inhibit allergic reactions in guinea pigs due to the presence of an allergy inhibitor, dimethyl myoinsitol in the latex of the plant (Sakurai et al., 1992). The inhibition rates of the passive cutaneous anaphylaxis reaction were 34.2% for dimethyl myoinsitol and 55.0% for butanol extracts of the plant latex, suggesting that the latex contains more than one allergy inhibitor.

Anti-carcinogenic and anti-inflammatory activity of laticiferous plants

Euphorbia prolifera is used for the treatment of inflammation and tumors (Watt and Breyer-Brandwijk, 1962). Five tigliane-type diterpene esters were isolated from the latex of *E. prolifera*. Two of these compounds were assayed on the mouse ear for activity, 2 compounds did not have an irritant effect on the mouse ear, and one compound was weakly active (Wu et al., 1994).

Choedon et al. (2006) reported that the dried latex of *Calotropis procera* has the potential for anti-cancer therapy in mouse model of hepatocarcinoma due to its differentiable targets and non-interference with regular pathway of apoptosis. It has been found that latex of *C. procera* act as an anti-inflammatory agent in laboratory animals affected with carragenin or formalin –induced paw oedema (Kumar and Basu, 1994; Jangde et al., 1994; Arya and Kumar, 2005).

Mineral content of laticiferous plants

The latex of laticiferous plants contains mostly calcium and magnesium. Bair et al. (1992) reported that the latex of the leafy Euphorbia species, *E. lathyris, Euphorbia myrsinites* and *Euphorbia schimperi* contains more calcium than magnesium whereas latex from species with succulent stems such as *Euphorbia ornithopus* contains more Mg than Ca with exception of *Euphorbia stenoclada* and *Euphorbia virosa*. On the other hand, in some species of the genus Asclepias, Taraxacum, Chelidonium, Papaver and Lactarius, potassium is a dominant cation. In Sudan, Abbas et al. (1992) analysed the shade-dried leaves of *C. procera* and reported 94.62% dry matter, 20.88% ash, 19.62% crude protein, 2.25% oil, 43.6% acid detergent fibre, 19.46% neutral detergent fibre, 0.02% calcium, 5.14% magnesium, 0.5% phosphorous, 0.2% zinc and 0.04% iron.

Proposed commercial uses of laticiferous plants

Wood is becoming scarce in parts of Africa. Methane production by anaerobic fermentation of laticiferous plants can relieve poverty and deforestation. It has been suggested that biomass production using plants such as *Euphorbia tirucalli* and *Euphorbia balsamifera* and fermentation machinery are necessary to effectively capture the energy held in the latex (Depeyre et al., 1994). In African countries, political will is needed to set the wheels in motion for the application of this technology.

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