

A review of *Zizyphus spina-Christi*

This article follows on from a *Personal Care* series reviewing Far Eastern plants which are known for their use in traditional medicine and which have also been shown to be excellent in cosmetic and toiletry applications.

Background

The genus *Zizyphus* belongs to the buckthorn family (Rhamnaceae). It is a genus of about 100 species of deciduous or evergreen trees and shrubs distributed in the tropical and subtropical regions of the world. Some species, like *Z. mauritiana* and *Z. jujuba*, occur on nearly every continent, whereas other species, like *Z. nummularia*, *Z. spina-Christi* and *Z. mucronata*, are restricted in their distribution to distinct areas. *Zizyphus* species can grow either as trees and shrubs (*Z. mauritiana*, *Z. rotundifolia*, *Z. jujuba*, *Z. mucronata*) or exclusively as small shrubs or bushes (*Z. nummularia*, *Z. lotus*, *Z. spina-christi*, *Z. obtusifolia*). In Oman, the most widespread indigenous fruit tree that grows in wadis throughout the country is *Z. spina-christi*, and the small brown fruits are sold in the suk [Lawton].

Latin names

Zizyphus spina-Christi [syn. *Z. spinosa*, *Rhamnus spina Christi*, *Paliurus spina-christi*, *Paliuris virgatus*, *Paliuris australis* (Gaertn.), *Paliuris aculeatus* (Lam.)]. The literature is quite confused on other possible synonyms *Rhamnus paliurus*, *Zizyphus spinosa*.

Alternative common names

The Arabs call it Nabka [Grieve]. Sudan: Nabag, Nabak, Cidir, Christ's thorn (in folklore, the plant is said to be the source of the crown of thorns placed on the Saviour's head [Levy]). Nigeria (Hausa): Kurna. In English it is known as Dom, Jerusalem-thorn or Christ-thorn, In French it is called Paliure, épine du Christ, porte-chapeau, capelets, argolou and amaves.

Perfumery

The chemical composition of the oil of *Zizyphus spina-christi* (L.) Willd. leaves obtained by hydrodistillation had the major components: geranyl acetone (14.0%), methyl hexadecanoate (10.0%), methyl octadecanoate (9.9%), farnesyl acetone C (9.9%), hexadecanol (9.7%) and ethyl octadecanoate (8.0%) [Ghannadi *et al*].

Uses

All parts of the plant are used by the local Arab people to help maintain a healthy lifestyle. The plant has also been used for its soothing properties [Adzu *et al*]. In Saudi Arabia it is used for the treatment of ulcers, wounds, eye diseases and bronchitis. The Bedouin use it for the treatment of wounds, skin diseases and as an anti-inflammatory. They also use it as a febrifuge and diuretic.



Zizyphus spina-Christi.

Spina-christi is a tree indigenous to the south of Iran. The leaves of this plant, which are locally known as "Sedr" and "Konar", have been used for washing the hair and body. Plant leaves are also used in Iranian folk medicine as an antiseptic, antifungal and anti-inflammatory agent, and for healing skin diseases such as atopic dermatitis [Amin; Nafisy]. In China it has been used as a form of birth control.

Aqueous leaf extract of *Zizyphus spina christi* may possess antinociceptive properties in the rat and have a calming effect on the central nervous system. [Effraim *et al*]. It has been described as anticathartic, astringent, diuretic and tonic [Duke & Ayensu].

Description

It is a deciduous shrub growing to 5 m by 5 m at a medium rate. It is hardy. It is in flower from July to August, and the seeds ripen from October to December. The scented flowers are hermaphrodite (have both male and female organs). The plant has small white woolly flowers that are highly scented and honey-like [Levy].

Chemical composition

The plant has been extensively studied [Ikram *et al*; Aynehchi *et al*] and its chemical composition is well-known [Younes *et al*; Mahran *et al*]. The main constituents of the essential oil were alpha-terpineol (16.4%) and linalool (11.5%). The main neutral hydrocarbons were n-pentacosane forms (81%). Methyl esters isolated from leaves included methyl palmitate, methyl stearate and methyl myristate. beta-Sitosterol, oleanolic acid and maslinic acid were the main aglycones of the glycosides present in leaves.

Sugars present in leaves included lactose, glucose, galactose, arabinose, xylose and rhamnose. The plant also contains four saponin glycosides [Mahran *et al*]. The highest flavonoid content was found in the leaves (0.66%). No significant influence of growing site or year of

harvesting on the flavonoid content was observed. As quercetin 3-O-rhamnoglucoside 7-O-rhamnoside and rutin are the main flavonoid compounds present in all plant parts investigated [Brantner *et al*]. The composition of the plant has always proved complex in its chemistry, in addition to the known alkaloids, zizyphine-F, jubanine-A and amphibine-H, a new peptide alkaloid spinanine-A has been isolated from the stem bark of *Zizyphus spina-christi*. Spinanine-A is a 14-membered cyclopeptide alkaloid of the amphibine-B type [Abdel-Galil *et al*].

Anti-microbial activity

Zizyphus spina-Christi has been shown to have activity against bacteria and fungi [Shat *et al*] and also other pathogens that are normally quite resistant [Nazif *et al*].

Antioxidant activity

The polyphenols of Yemeni plants were evaluated by ferrylmyoglobin assay to determine their antioxidant activity. *Zizyphus Spina-Christi* was shown to reduce oxidative degradation. The protective effects of total saponins of *Zizyphus Spina-Christi* on cultured myocardial cells exposed to anoxia-reoxygenation was determined and it was found that the peroxidation of lipids was reduced.

Food use

The chemical constituents confirm the fruit's beneficial use as a tonic (Table 1). The fruits taste like a mixture of dates and apples and are highly prized by the Bedouins and were found to have a very high energy value. Fruit can be eaten raw or dried for later use and has a pleasant sub-acid taste, somewhat resembling dried apples [Facciola]. Only dates, figs, raisins and a few other dried fruits have a higher value. The seeds were rich in protein and the leaves in calcium, iron and magnesium. The food from this plant is an important source of energy, protein and minerals.

The berries are tonic and will revive a failing appetite. They are also laxative and have been used as a vermifuge. It refreshes and restores, improves memory and is a remedy for high blood pressure [Levy]. In the western part of Sudan the cherry-type fruit is considered a delicacy; (Kordofan, Darfur): the bitter-sweet pulp of fruit is dried and milled to produce fine flour. One method to use this flour is to place it in small metallic cups and cook them with steam – a process that sets the flour in the shape of the cup. The dried pulp-flour and water are also mixed with sesame and formed into small balls for immediate use or for use later. The seed coat is also cracked open and the kernels eaten raw. In Nigeria (Kano State,

TABLE 1: THE NUTRITIONAL COMPOUNDS IN ZIZYPHUS SPINA-CHRISTI.

Chemical composition per 100 g fruit, dried			
Alanine	3.4 g	Lysine	2.3 g
Arginine	3.4 g	Magnesium	0.12 g (dry)
Ash (insoluble)	4.4 g (dry)	Manganese	13 mg/kg (dry)
Aspartic acid	15.1 g	Methionine	0.4 g
Calcium	0.61 g (dry)	Na	0.01 g (dry)
Starch	21.8 g (dry)	Phenylalaine	2.2 g
Copper	5 mg/kg (dry)	Potassium	0.13 g (dry)
Cysteine	0.5 g	Proline	5.3 g
D-fructose	16.0 g (dry)	Protein (crude)	4.8-5.6g (dry)
D-glucose	9.6 g (dry)	Serine	3.9 g
Fat	0.9 g [2.1 g (dry)]	Sucrose	21.8 g (dry)
Fe	3.0 mg	Sulphur	0.04 g (dry)
Fibre (crude) (dry)	4.1 g (dry)	Threonine	2.2 g
Glutamic acid	17.6 g	Tyrosine	1.8 g
Glycine	3.1 g	Valine	3.1 g
Histidine	0.9 g	Vitamin B1	0.04 mg
Iron	20 mg/kg (dry)	Vitamin B2	0.13 mg
Isoleucine	2.3 g	Vitamin C	30 mg
K	1.91 g (dry)	Zinc	9 mg/kg (dry)
Leucine	3.9 g		

northern) the fruits are eaten.

Hypoglycemic and antihyperglycemic effects of *Zizyphus spina-Christi* has been demonstrated [Glombitza *et al*; Zakaria *et al*].

Skin and hair care – recent studies

The plant is already used in many parts of the world for the care of the skin [Abbiw]. The chemical composition and phytochemicals present in the plant would suggest and substantiate the ethnobotanical and cultural reliance on this plant. Application of the powdered leaves is said to darken and lengthen women's hair [Irvine].

Protect against skin reddening

A study was conducted where a 10% aqueous extract *Zizyphus Spina-Christi* powder (prepared by steeping the herb in water for 24 hours) was evaluated on UV-irradiated skin using an Oriol solar simulator and a single application of the gelled product. The skin was evaluated for colour (specifically for the skin redness) using a Minolta Chromameter. 80% of subjects showed a reduction in the skin reddening and the gel reduced the redness by 17.51% across all subjects. The use of this product as an after sun product would be suggested. [Summary of results on record].

Provide antioxidant activity

Lipid peroxidation plays an important role in the generation of problem skin and scalp conditions by involving changes in the sebum composition leading to

increases in the immune reaction of the skin. Peroxidation and other oxidative breakdowns can be caused by environmental challenges that generate free radicals (such as exhaust pollution, industrial fumes, ozone, UV light, cigarette smoke, etc.) and by biological challenges such as micro-organisms and other detrimental conditions. This can result in problems for the skin and scalp. To avoid the side effects of the lipid peroxidation, the use of an antioxidant is a relevant response. [Summary of results on record].

An extract of *Zizyphus spina-Christi* was prepared by infusing the dried leaves at a concentration in deionised water for 24 hours. The infusion was decanted from the suspension of the leaves. 1% of this solution was added to a linoleic acid suspension.

Method summary: Lipid peroxidation (LPO) was increased using a colorimetric assay (K-assay) adapted for use in a 96-well microtitre plate reader. The plate was filled with linoleic acid dispersions, with and without *Zizyphus Spina-Christi* extract and one half was irradiated for 30 minutes using a solar simulator. LPO levels were compared to a hydroperoxide standard. The difference between the irradiated and non-irradiated samples was calculated to give the final percentage reduction in lipid peroxidation.

Results: 1% of the 10% *Zizyphus spina-Christi* extract reduced lipid peroxidation by 66% compared to the untreated control – a result that is comparable to an antioxidant such as tocopherol (vitamin E).

Protect against DNA damage

The efficacy of *Zizyphus spina-Christi* to protect human cell lines against damage from actinic radiation was assessed using a modified control assay by Regentec, a spin out research company from Nottingham University. Damage to human DNA can be caused by similar challenges described in the antioxidant work above. [Summary of results on record].

Method summary: Six well plates are seeded with human keratinocyte cells and cultured to produce keratinocyte film. Control and *Zizyphus* extract was added to the cell culture and the plates exposed to a standard UV radiation dose. The cells were then washed and collected and placed on a gel electrophoresis plate and run using standard conditions. The resulting comets were assessed using fluorescence microscopy and image analysis software.

Results: The damage due to UV exposure is calculated by subtracting the unexposed value from the exposed value. The results showed that the *Zizyphus* extract provided protection leading to 61% less DNA damage.

Patent status: Patent is held for the use of *Zizyphus spina-Christi* in cosmetics and psoriasis [Safai-Ghomi].

Toxicity: *Zizyphus spina-Christi* showed no significant changes in the biochemical parameters studied. The frequency of micronuclei did not increase and the plant was found devoid of clastogenic activity. Teratogenicity data revealed no teratogenic or fetotoxic effects in the study. Oral LD50 values were determined for *Zizyphus spina-christi* (>6400 mg/kg) [Islam et al].

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