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Phytopharmacology of Khajur (*Phoenix dactylifera* L.)

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ABSTRACT

Khajur (Date palm) is an edible fruit cultivated for its nutritional benefits and useful medicinal properties. The fruit is oval, cylindrical or oblong depending upon its variety and is commonly known as Date. The Date palm is highly prized as an ornamental tree. It has been shown to possess useful medicinal properties such as anti-oxidant, anti-mutagenic, anti-cancer, nephro-protective, anti-hyperlipidemic, phytoestrogenic, neuro-protective, hepato-protective properties. Different parts of this plant are traditionally used for the treatment of a broad spectrum of ailments including memory loss, fever, childlessness and nervous disorders. Phytochemically, the whole plant contains carbohydrates, alkaloids, steroids, flavonoids, vitamins and tannins. In the light of above, we thought it worthwhile to compile an up-to-date review of Khajur covering its traditional uses, synonyms, chemical constituents and phytopharmacology.

Key words : *Phoenix dactylifera*, Date Palm, Khajur

INTRODUCTION

Khajur (*Phoenix dactylifera* L.) belongs to the family Arecaceae and is cultivated as Date palm tree. According to Islamic tradition, the Date tree was said to be the “tree of life” in the Garden of Eden and provided rich nutritional components to Mary, when she was pregnant with Prophet Jesus. It is traditionally believed that consumption of Khajur (Date fruit) particularly in the morning on an empty stomach can reverse the actions of any toxic substance that might have been consumed previous day.

Biological source:

Date palm is the fruit of *Phoenix dactylifera* L.

Common names:

Phoenix dactylifera, Date Palm, Khajur, Medjool, Simhi, Duraruha, Kharaskhandha, Kasaya, Kharjurika, Haripriya and Duspradharasa.

Indian names:

Hindi: Khajur, Sendhi, Salma, Khaji, Ittappuzham, khorjjuri

Tamil: Itcham-pannai or tnehu, karchuram, perichchankay

Bengali: Khajur

Sanskrit: Kharjura

Telugu: Peddaita

International Names:-

English: *Phoenix dactylifera*, wild date palm, date, sugar palm, date palm

Arabic: Nakl, Nakhla Balah, Temer, khuriude-yalis and Tamar

Chinese: Hai zao, Ye zao, Zao ye, Zao ye zi

Creole: Datte

Danish: Daddelpalme

Dutch: Dadel palm

French: Dattier, Dattie, Palmier

Finnish: Taatelipalmu

German : Dattel palme

Italian: Palma deldattero

Japanese: Natsume yashi, Natsume yashi.

Nepalese: Chohoraa.

Norwegian : Daddel, Daddelpalme

Polish: Daktylowiec.

Portuguese : Tamara, Tamareira

Spanish: Datil, Datilera, Palmera

Swahili: Mtende.

Swedish : Dadelpalm

Tigrigna: Temri

Thai: Inthaphalam (fruit), Ton inthaphalam (palm).

Russian : Finikovaia pal'ma, Pal'ma finikovaia

Table 1 : Taxonomy

Domain	Eukaryota	Super order	Arecales
Kingdom	Plantae	Order	Arecales
Subkingdom	Viridiplantae	Family	Areaceae
Division	Magnoliophyta	Subfamily	Coryphoideae, Phoenicoideae
Phylum	Tracheophyta	Tribe	Phoeniceae
Subphylum	Euphyllophytina	Genus	Phoenix
Infraphylum	Radiatopses	Specific epithet	dactylifera
Class	Liliopsida	Cultivar	Meedjool
Subclass	Arecidae, Commelinids	Botanical name	<i>Phoenix dactylifera</i> L.

History of *Phoenix dactylifera*:

Phoenix dactylifera (Date palm) is a member of Palm family, a group of trees with no branches, topped by large crowns of leaves. It is cousin to lily, orchids and grasses and truly a child of the desert. One ancient Muslim tale describes the Date palm as the chief food created by God to nourish Adam in the Garden of Eden. It was said to be the 'Tree of Life' in the Garden of Eden, and 'Tree of Love' in Bible in the 'Song of Solomon'. The Prophet Mohammed's favorite fruit was Date and it is described as 'God's Bounty' in the Koran. Muslims also break their Ramadan or New Year's fast each night by eating a Date. Phoenix in ancient Greek is the name of a legendary bird that 'lives forever.' This bird before dying builds its own funerary pile, sets fire to it with its magical wings and rises again from its ashes. The oldest discovery of Date seeds was on Dalma island, part of the Abu Dhabi Island group. Two seeds were found in 1998, the oldest was 5110 BC and other 4670 BC. As there was no evidence of cultivation of Date palms in the region at that time, it is probable that these seeds came from traders. Date Palm seeds dating back 50,000 years have been found in the Shanidar caves of Northern Iraq. The Sumerians were cultivating the palm by about 5000 BC. The Sumerian words for date (Zulum) and date palm (gishimmar) belongs to a group of words considered by Sumerologist Benno Landsberger to be non Sumerian loan words from a hypothetical pre-Sumerian language associated with a pre-Sumerian aboriginal population. This suggests that the Date was known before the Sumerians and may be it was an indigenous plant in that region. The Sahara people, the first Arabs, lived in the Dhofar region as early as 5000 BC. They cultivated the Date Palm, as evidenced by Stone Age drawings of Date palms found near modern day Salalah. Earliest form of date palm cultivation coincide with the oldest civilization and originated in the north-east Africa, stretching north east into the delta of Euphrates and Tigris from there, it spread either purposefully or accidentally with the movement of population. The earliest

discovery was in the Indus valley (now Pakistan) where silicified seeds of 6th millennia BC have been tested. Five thousand year old seeds of Date have been found in storage vases along the Indus River in the 'Sind' region. The botanical and geographic proximity of the sister species *Phoenix sylvestris* (Indian sugar Date Palm) reinforces the argument that *Phoenix dactylifera* also originated in the Indus Valley. There is archaeological evidence of Date cultivation in eastern Arabia in 6000 BC.

Description:

Date palm trees are essential integral components of farming systems in dry and semi-arid regions and can be produced equally well in small farm units or as larger scale commercial plantation units. *Phoenix dactylifera* L. (date palm) a diploid with $2n=36$, is a member of the monocot family Areaceae and is classified as a dioecious tall evergreen tree. The tremendous advantage of this tree is its resilience, its requirement for limited inputs, its long term productivity and its multiple purposes attributes. *Phoenix dactylifera* is characterized by its tall trunk up to 25 m, its large leathery, feather-shaped leaves, and its ability to produce basal suckers. The date palm may reach an age of over 100 years.

Leaves :

Leaves are alternate, spiral, compound, sheathing, petiolate, (petiole 1000mm long) and pinnate (with 50-130 pairs of leaflets, the original leaves splitting to form leaflets folded as 'gutters'). The large greenish or bluish grey pinnate leaves are typically 18-20 ft (5.5-6.1m) long by 2ft (0.6m) wide. They are arranged in a thick canopy up to 40 ft wide. Leaflets are 1-2 ft (0.3-0.6 m) long and arranged in v shape ranks that run the length of the leaf stem. Leaflets near the base are modified into sharp 3-4 inches (7.6-10.2 cm) spines. Dates are formed from flowers on 4ft (1.2m) inflorescences that emerge from among the leaves in the spring.

Flowers:

Some 12 flower buds develop during the winter in the axils of some of the leaves just below the growing point. Male and female flowers grow on separate plants. Only female plant produces dates. Female flowers consist of three carpels with ovules, of which normally one will develop into fruit. Male flowers are sweet scented and have six stamens. Dates are naturally wind pollinated but in both traditional oasis horticulture and in modern commercial orchards they are entirely pollinated manually. Manual pollination is done by skilled laborers on ladders, or in some areas by using special climbing technique. Pollens may be blown on female flowers using wind machine. Flowers bloom in the period of January and February and color of flowers is pale yellow.

Fruits:

The fruit is indehiscent, a drupe or a berry known as date. They are oval- cylindrical or oblong, 3-7 cm long, and 2-3 cm diameter, and when unripe range from bright red to bright yellow in colors, depending on variety. There flesh is sacchariferous, and contain a single woody seed about 2-2.5 cm long and 6-8mm thick. Dates ripen in four stages, which are known throughout the world by their Arabic names Kimri (Unripe), Khalal (full size, crunchy), Rutab (ripe, soft), Tamer (ripe, sun dried). The fruit quality varies in the same female cultivars depending on male cultivars used for pollination. From the date of pollination, the fruit takes 200 days to reach ripe stage. During ripening the fruit passes through several stages beginning with:

- Hababauk which is the week during which the female is pollinated
- Traditionally, the fruit remains on the tree either until the Rutab stage, when the fruit turns brown, reduces weight due to moisture loss (moisture level of 35-40%) and softens.
- Some fruit is left on the tree until it reaches Tamer, a dried brown date with 20- 24% moisture content. This fruit is harvested and sent for processing, packaging or value adding as confectionery. Harvesting can also be at early Rutab stage; then the fruit is spread out on mats for further drying to Tamer stage.

Roots:

Roots of the date palm originate from the ball shaped foot of the trunk and are singular with little or no secondary thickening or branching in to rootlets. The date palm has no tap root, but 4 zones in the root system can be distinguished.

Miscellaneous uses:

The date palm is highly prized as an ornamental tree;

as it is ideally situated in streets, avenues and driveways. The wood and leaves provide timber and fabric for house and fences. The leaves are used for making ropes, cords, baskets, crates and furniture. Bases of leaves and fruit stalks are used as fuel. The fruit yields food products such as date- vinegar, date- chutney or sweet pickle. Date fruit paste is useful in bakery products for additional flavoring along with oranges, bananas and almonds and it displaces the need for artificial preservatives and additives. Seed oil is used for soap manufacturing. Dried leaf petioles of Date tree are a source of cellulose pulp, used for walking sticks, brooms, fishing floats and fuel. Dried dates are fed to camels, horses and dogs in the Sahara. Viscous, thick syrups made from the ripe fruits is used as a coating for the leather bags and pipes to prevent leaking. Seeds are processed chemically as a source of oxalic acid. These are burned to make charcoal for silversmiths, and can be strung in to necklaces.

Cultivation and propagation:

The statement that the Date palm tree likes its “feet in Heaven and head in hell alludes to the fact that the date palm requires an abundant water supply and high temperature for its basic growth. Date palm can survive in wide range of temperatures. The Date palm will flower only when the shade temperature rises over 18° C. The Date will fruit at temperature above 25° C and vegetative growth will not take place below 10°C. For the mature palms, water requirement is 70 liters for every ten days in winter and as much as 70 liters for every two days in summer. Date palm begins their productive life at about 5-8 years and they reach maturity at 30 years. Normal and healthy trees may produce 10-30 or more off-shoots. Off shoots are buried firmly up to their maximum diameter, taking care of that crown remains 10-15 cm above the soil so that irrigation water does not touch it. Apricots, grapes oranges, peaches, pomegranates etc are intercropped. According to the World Food and Agricultural Organization, there are 90 million tons of Date Palms in the world and each tree can grow for more than 100 years. 64 million of these trees are grown in Arab countries, which produce 2 million tons of Dates each year.

Chemistry:

Phytochemically, the whole plant contains carbohydrates, alkaloids, steroids, flavonoids, vitamins and tannins. The phenolic profile of the plant revealed the presence of mainly cinnamic acid (ferulic, sinapic and coumaric acids and their derivatives, such as 5-o-caffeoylshikimic acid also called as dactyliferic acid), flavonoid glycosides (luteolin, quercetin, and methyl

Table 2 : Cultivars of dates

Variety	Character	Country
Ajwah, Khalasah, Mishriq	Sweetness level is not high not low so suits everybody	Saudi Arabia
Al-Barakah	Soft, thin skin, thick flesh	Saudi Arabia
Amer Hajj	High quality, little spoilage of fruit in wet weather	Iraq
Barhee	Cylindrical, light amber to dark brown when ripe; soft with thick flesh and rich flavors	Arabic barh
Deglet Noor	Centre appear light or golden, semi dry and not very sweet, long fruit stalk	Algeria, USA, Tunisia
Derrie or Dayri	Long, slender, nearly black and soft, rich flavors, moisture tolerance, good size, semidry texture	Southern Iraq
Empress	Light tan top half and brown bottom half, sweeter than deglet noor	California
Holwah	Soft, extremely sweet, small to medium in size	Arabic
Hayany	Dark red to nearly black and soft	Egypt
Kajur	Dark brown	India/ Pakistan
Khadrawy	Soft, dark, dwarf stature, moisture tolerance, early maturity	Arabic
Khastawi	Leading soft date, syrupy small in size	Iraq
Maktoom	Large, red brown, thick skinned, soft medium-sweet date	Arabic
Manakabir	Large fruit which ripens early	Arabic
Medjool	Large, sweet ,succulent, good quality, early maturity, moisture tolerance	Morocco, USA, Saudi Arabia, Jordan and Israel
Migraf	Large golden amber dates	Southern Yemen
Rodab	Dark and soft	Saudi Arabia
Saidy	Soft, very sweet	Arabic
Sayer	Dark orange brown, medium size, soft and syrupy	Arabic
Sekkeri, Sellaj	Dark brown skin, sweet, soft flesh	Saudi Arabia
Thoory	Brown red, very wrinkled skin, moisture tolerance, late maturity	Algeria
Umelkhashab	Brilliant red skin, bitter sweet, hard white flesh	Saudi Arabia
Zahidi	Medium size, cylindrical, light golden brown, semi dry, very sugary	---

quercetin), flavanols (catechin, epicatechin) (Biglari *et al.*, 2008). Four free phenolic acids (procatechuic acid, vanillic acid, syringic acid and ferulic acid) and nine bound phenolic acids (gallic acid, procatechuic acid, p-hydroxybenzoic acid, vanillic acid, caffeic acid, syringic acid, p-coumaric acid, ferulic acid and o-coumaric acid) were tentatively identified (Eong *et al.*, 2006; Ziouti *et al.*, 1996.). The Thin layer chromatography (TLC) analysis revealed the presence of steroids namely cholesterol, stigmasterol, campesterol and α -sitosterol. The TLC analysis also showed that the major carotenoid pigment present in date is lutein followed by α -carotene (Al-Farsi *et al.*, 2005; Boudries *et al.*, 2007). Moreover, the gas liquid chromatography of the date seed oil revealed the presence of oleic, lauric, palmitic, capric, myristic, myristoleic, palmitoleic, stearic, linoleic and linolenic acids. The fatty acid composition of the seed oil is 8% lauric acid, 4% myristic, 25% palmitic, 10% stearic, 45% oleic, 10% linoleic with some capric and caprylic acids. Enzymes such

as phytase, invertase and peroxidase are reported. Dates contain at least six vitamins including a small proportion of Vitamin C, and Vitamin B₁, thiamine, riboflavin, nicotinic acid and vitamin A. The fruit pulp is reported to contain 317 calories, 15.3g H₂O, 2.5g protein, 0.4g fat, 75.8g carbohydrate, 3.9g fiber, 2.1g ash, 120mg Ca, 50mg P, 7.3mg Fe, 26 μ g β - Carotene equivalent, 0.01mg thiamine, 0.02mg riboflavin, 0.9mg niacin, and 3 mg ascorbic acid per 100g. The wealth of India also reports the mineral composition of exotic dried dates 754mg K, 68 mg Ca, 58 mg Mg, 1.6mg Fe, 0.21mg Cu, 64mg P and 51mgS/100g. Zinc, arsenic and 6.3 μ g I/100g were also reported. Fruit pulp also contains leucanthocyanins, pipercolic acid, 5-oxypipercolic acid, (C₆H₁₁NO₃) and piperidine derivative biakiaian (C₆H₉NO₂) as well as tannin. Chromatographic investigations of non polar extracts of the seeds of dates revealed that the unsaponifiable fraction contained 66.5% carbon and 15.6% of terpenoidal compounds (Cholesterol, β -Sitosterol, Campesterol, Campesterol, β -amyrin in a

percentage of 3.2, 2.8, 2.6 and 3.8 %, respectively). The fruit of the date palm contains a high percentage of carbohydrate (total sugar, 44-88%), fat (0.2-0.5%), salts, minerals, proteins (2.3-5.6 %) tannins and a high percentage of dietary fiber (4-11.5% and 0.5-3.9% pectin (Al-Sahib and Marshall, 2003).

– Jaggery made from the sap of the tree boils down to 9.6% moisture, 86.1% carbohydrates, 13.6% fiber, 1.5% proteins, 0.3% fat, 2.6% minerals, 0.36% calcium and 0.06% Phosphorous (C.S.I.R., 1948-1976).

– Leaves contain luteolin-7-glucoside, luteolin-7-rutinoside and glycosylapigenin.

– Pollens contain cholesterol and rutin. The hemicellulose of pollen contain 46% sarabinose, 25% galactose, 18% xylose, 9% rahnose, and 25% uronic acid.

Table 3 : Inorganic constituents of dates (mg/100g dry weight)

Elements	Halaway	Sayer
Potassium	716.0	657.0
Sodium	37.0	38.0
Calcium	65.0	97.0
Magnesium	71.0	79.0
Phosphorous	84.0	63.0
Iron	3.7	3.1
Aluminium	5.1	-
Copper	0.2	0.2
Sulfur	52.0	59.0
Manganese	3.3	4.6
Silicon	66.0	66.0
Chlorine	27.0	31.0

Pharmacological activities:

Antioxidant activity:

Aqueous date extract was found to inhibit significantly the lipid peroxidation and protein oxidation and also exhibited potent super oxide and hydroxyl radicals scavenging activity in a dose dependent manner in an *in-vitro* study. Both polar (methanol and 50% aqueous methanol mixed) and non-polar (petroleum ether and ether) extracts of date fruit seeds showed antioxidant activity of different degrees which may attributed to the presence of sterols, tannins and flavonoids (Nagwa *et al.*, 2009). Methanolic extracts of *Phoenix dactylifera* seeds showed a significant increase in plasma levels of vitamin C, E and A, β -carotene and significant decrease in the elevated MDA levels due to lipid peroxidation in adjuvant arthritis in rats. These findings suggest its possible use in diseases such as scurvy, ataxia and night blindness caused due to

the deficiency of vitamin C, E and A, respectively (Mohammed and Al-Okbi, 2004). Date seed oil was found to limit oxidative injuries induced by hydrogen peroxide in human skin organ culture, which confirmed the potent free radical scavenging activity of the plant

Anti-mutagenic activity:

Date fruit extract also produced a dose dependent inhibition of benzo (a) pyrene induced mutagenicity on Salmonella tester stainsta-98 and TA-100 with metabolic activation. This observation indicated that Date fruit possessed potent anti-mutagenic activity (Vaylil, 2002).

Anticancer activity:

The polysaccharides (glucans) prepared from the date fruits exhibited a dose dependent anti-cancer activity with optimum activity at the dose of 1mg/kg in tumor induced by subcutaneously transplanting allogenic solid Sarcoma-180 tumor cells in to right side of female CD₁ mice (Ishurda and John, 2005). This research validates the traditional claim of date fruits as an anti-cancer agent

Nephroprotective activity:

The extract of Date flesh and pits of Dates were investigated on gentamycin (GM) induced nephrotoxicity in rats. It was found that Date flesh significantly reduced the elevated levels of plasma creatinine and urea concentrations induced by GM nephrotoxicity in rats and ameliorated the proximal damage. Antioxidant components in the date (e.g., melatonin, vitamin E and ascorbic acid) were suggested to be the basis of the nephroprotection (Al-Qarawi *et al.*, 2008).

Antihyperlipidemic activity:

Diets containing 2.5% Date seed fiber exhibited anti-hyperlipidemic activity in male Wister rats. Date seed diet successfully reduces LDL, cholesterol, total cholesterol and plasma triglycerides after 27 days of administration in rats (Salah and Maiman, 2005).

Anti-viral activity:-

The Date pit extract showed a strong ability to inhibit the infectivity of the lytic Pseudomonas phage ATCC-14209-B1 and completely prevented bacterial lysis (Burgoyne and Tan, 2008). This finding suggests that Date fruit can be used as potential novel anti-viral agent against pathogenic human viruses.

Anti-diarrhoeal activity:

The aqueous extract of Date palm spathe showed significant reduction in castor oil induced intestinal transit

and diarrheal frequency in rats (Abdulla and Al-Taher, 2008). This observation reveals the fact that *Phoenix Dactylifera* L. contains pharmacologically active substance, which possess anti-diarrhoeal properties

Phytoestrogenic activity:

Treatment of immature female rats with Date seed polar (methanol and 50% aqueous methanol mixed) and non polar extracts (petroleum ether and ether) showed significant increase in the plasma level of estrogens. Date seeds exhibited estrogen like activity, which may be attributed to the presence of flavonoids (isoflavones) and tannins (Nagwa *et al.*, 2009).

Antiulcer activity:

Pretreatment with ethanolic and aqueous extract of date fruit at a dose of 4ml/kg for 14 days markedly ameliorate the ulcer index, histological indices such as necrosis, hemorrhage, congestion and oedema in stomach section and biochemical levels of some enzymes such as gastrin in plasma and mucin and histamine in gastric mucosa of ethanol induced gastric ulceration in rats (Al-Qarawi *et al.*, 2005). Non-dialyzed extract is more active as gastroprotectant as compare to the dialyzed extract.

Neuroprotective effects:

Treatment of rats with aqueous date fruit extract significantly decreased neural death in CA1 hippocampal neurons comparing to the control. Cerebral ischemia was produced using the middle cerebral artery occlusion method (Majid *et al.*, 2008).

Hepatoprotective activity:

Pre and post treatment with aqueous extract of date flesh or pits significantly reduced CCl₄ induced elevation in plasma activities of aspartate aminotransferase (AST), alanine aminotransferase (ALT), alkaline phosphatase (ALP) enzymes and bilirubin concentration and ameliorated morphological and histological liver damage in rats. The study suggests that CCl₄ induced liver damage in rats can be reversed by treatment of extracts from date flesh or pits. (Al-Qarawi *et al.*, 2004). In another study the date flesh or pit extracts not only normalized the elevated plasma activities of AST, ALT, GT), enzymes and α glutamyl transferase α ALP, lactate dehydrogenase (LDH)), plasma concentration of bilirubin but also exhibited an enormous increase in the reduced serum level of testosterone, alpha fetoproteins (AFP) and glucose in the thioacetamide induced cirrhotic rats. The extracts also showed significant reduction in oxidative stress evidenced by significant rise in the hepatic monoaldehyde (MDA)

levels and decline in hepatic glutathione levels by normalizing them (Mohammad *et al.*, 2008). The data suggested that the daily oral consumption of an aqueous extracts of dates, and as part of the daily diet ad libitum, was prophylactic to thioacetamide poisoning.

Effect on cisplatin- induced genotoxicity:

Aqueous extract of pollen grains administered by the oral route to mice at doses of 250 and 500mg/kg significantly inhibited the cisplatin-induced genotoxicity. At histopathological levels, a significant recovery of the testis histology was observed in animals administered with pollen grains prior to cisplatin treatment. Furthermore, administration of the pollens extract caused a decrease in epididymal sperm with tail abnormalities that would interfere with sperm motility, and the highest dose retained normal epididymal sperm number. These findings suggest the preventive role of the pollen grains against the chemotherapeutic- induced infertility in males (Al-Kharage and Rokaya, 1982). Date extracts have been shown to increase sperm count in guinea pigs and enhance spermatogenicity and increase the concentration of testosterone, follicle stimulating hormone and luteinizing hormone in the rats (Elgasim *et al.*, 1995).

Folk medicine:

The date fruit is listed in folk remedies for the treatment of anemia, asthma, bronchitis, cancer, chest complaints, condylomata, cough, diarrhea, fatigue, fever, gonorrhoea, longevity, piles, sterility, stomachache, thirst, toothache, tuberculosis, virility, warts, whitlows and urogenital ailments. Medicinally, the fresh date juice is cooling and laxative. The squash of date fruit is recommended in rheumatoid arthritis. One traditional belief is that it can counteract alcohol intoxication. Kharjura mantha the preparation of fruit crushed and churned with water is extremely beneficial for athletes for the quick energy regain. Kharjurasava is a commonly used preparation in the treatment of anemia, tuberculosis, piles, hepatitis and diabetes. Ethanolic extract of date pits showed weak anti-microbial activity on several strains of microorganisms. Dates have high tannin contents and are used medicinally as astringent in intestinal troubles. Tackholm and Drar (1973) reported one "superstition" that "The pollens of a male date palm mixed with water is a charm against childlessness". Date palm kernels have been shown to exhibit anti-ageing properties and produce significant reduction in skin wrinkles in women. The gum is useful in the treatment of diarrhea and diseases of genitourinary system. A plaster of nuts or of the bark is a folk remedy for whitlows, hardness and scirrhi. The powder of its roots is applied topically or the gargles along

with the decoction of roots alleviate toothache. Seeds mashed with water are used as a paste to reduce the pain and inflammation.

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