Phytopharmacological Review on Date Palm (*Phoenix dactylifera*)

KAMALIKA MANDA[2]*, BHUWAN CHANDRA JOSHI[1] AND YOGITA DOBHAL

Department of Pharmaceutical Sciences, Sardar Bhagwan Singh Post Graduate Institute of Biomedical Sciences and Research, Dehradun, Uttarakhand 248161, [1]Department of Pharmaceutical Sciences, Faculty of Technology, Kumaun University, Bhimtal Campus, Bhimtal, Uttarakhand 263136, [2]Gyani Inder Singh Institute of Professional Studies, Dehradun, Uttarakhand 248003, India

Manda *et al.*: Review on Date Palm (*Phoenix dactylifera*)

Now a day's many herbs and plants and their species consumed as a food in our daily life because of its effectiveness and preventive nature towards our health. The *Phoenix dactylifera* Linn. is a most common plant usually known as date palm, belonging to the family Arecaceae. It is native to North Africa, South-West Asia and is considered as an oldest plant. The date palm is well known for its traditional as well as medicinal value. The active phytoconstituents reported in the fruits are alkaloids, tannins, glycosides, flavonoids, steroids, terpenoids, carotenoids and also its fruits are rich source of vitamins, minerals, carbohydrates and proteins. From the existing literature survey *Phoenix dactylifera* is reported for number of pharmacological activities like analgesic, anti-inflammatory, hepatoprotective, anticancer, antioxidant, anti-proliferative, antifungal and antibacterial activity. This review basically focuseds on the nutritional value, active phytoconstiuents and pharmacological activities of the plant which will further helps to provide a detailed knowledge about the plant.

Key words: *Phoenix dactylifera* Linn., pharmacological activity, phytoconstituents nutritional value

For the development of Ayurvedic system of medicine in India the herbal plants play an important role because of their therapeutic activities[1]. Apart from Ayurveda, the traditional medicine also utilized as household remedies[2]. According to World Health Organisation (WHO) more than 80 % of population use folk medicine of traditional medicine for the maintenance of their health[3]. WHO has also stated that in all over the world more than 70 000 species of plants are used medicinally[4].

Phoenix dactylifera Linn. (*P. dactylifera*) is commonly known as date palm (fig. 1)[5] belonging to the family Arecaceae (formerly Palmaceae) and has near about 14 species; also it is consisting of about 200 genera and more than 2500 species. It is native to North Africa, south-west Asia and considered as an oldest plant. Traditionally it is important for its nutritional value throughout the world. Very currently the whole genome of date palm tree was again sequenced for the betterment of its growth[6]. The main nutrients of the plant are derived from the fruits. The fruits contain huge amount of carbohydrates, amino acids, vitamins and minerals. The active phytoconstituents present in the fruits are alkaloids, tannins, glycosides, flavonoids, steroids, terpenoids and carotenoids. Phytoconstituents like flavonoid is the main active constituent of the fruit which shows various pharmacological activities.

Fig. 1: *P. dactylifera* Linn. popularly known as date palm

***Address for correspondence**
E-mail: kamalika.goutam1@gmail.com

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Apart from the fruit the other parts of the plant like leaves, seeds and roots are also used medicinally. There are several varieties of date fruits and the nutritional values of its individuals are almost same. They all are rich sources of nutrients. From the existing literature survey *P. dactylifera* is reported for various pharmacological activities like analgesic, anti-inflammatory, hepatoprotective, anticancer, antioxidant and many more[7]. Their high nutritional value and their therapeutic effects have increased their use, encourage by the growing consumer concern for health. This review intent to summarize various studies on this plant and critically evaluate the issues associated to traditional uses, phytochemistry and pharmacology of *P. dactylifera.*

TAXONOMICAL CLASSIFICATION

Kingdom: Plantae; Subkingdom: Tracheobionta; Superdivision: Spermatophyta; Division: Magnoliophyta; Class: Liliopsida; Subclass: Arecidae; Order: Arecales; Family: Arecaceae; Genus: *Phoenix*; Species: *dactylifera*[8].

SYNONYMS

Arabic: Nakhleh; Croatian: Datulja; English: Date; French: Dattier; German: Daten; Greek: Phoenix; Italian: Date; Japanese: Natsumeyashi; Portugese: Datas; Russian: Finik; Spanish: Datiler; Turkish: Hurma[8].

VERNACULAR NAME

Bengali: Khejur; Gujrati: Khajur; Hindi: Khajur; Kannada: Khajura; Malayalam: Prantapuzam; Marathi: Khajur; Odisha: Khejuri; Panjabi: Pindakhajur; Sanskrit: Kharjur; Tamil: Perichampazham; Telegu: Khajurpupandu; Urdu: Khurma[8].

DISTRIBUTION

The people of Phillipines use *P. dactylifera* as an ornamental plant in garden and parks. It is well known to West Asia and North Africa. Since long time it is cultivated in North Africa, Arabian Peninsula and Middle East. The *P. dactylifera* is a well-known plant for mainly the sweet fruit called as date. The people, living in North Africa and the Middle East, depended on this plant which they used as a food source for thousands of years. It is also popular as an ornamental plant because of its prettiness and toughness. This plant is capable of surviving in different environmental conditions like that of mediterranean with chilled and wet winters. The plant is even capable of growing in hot and dry conditions like prevailing in deserts to moist tropical. For the ultimate growth this plant requires only unconditional full sun. Those places where the humidity of environment is high, the fruits are tends to be of poor quality and frequently dropping from the plant before ripening. It is now also cultivated in Iran, Iraq, USA, Pakistan, Saudi Arabia, Egypt, UAE, Sudan, South Sudan, Algeria, Tunisia, India, Spain, Maurutiana, Morokko, Mali, Oman, Tanzania, Australia and Libya[8].

BOTANICAL DESCRIPTION

The height of the tree is 36-40 m tall, generally found cultivated or self-grown in India. Trunks are covered by persistent bases of petioles, the inferior part of the plant generally covered by a mass of offshoots.

Leaves:

The leaves are linear, keeled lesser pinnae adapted into spines, pinnate 20-40 cm long.

Flowers:

The flowers are small and gather in branched spadices. The colour of the flowers is yellow. The lower part of the flower is connected straight to the spikelets which after grow into fruits.

Fruits:

The fruits are called as dates and appear as oblong berry. The size fruit is 2.6-7.6 cm long and the diameter is about 2-3 cm. The colour of the fruit is red or yellow brown when it ripe and in unripe condition it looks like deep green in colour. The varieties of fruit depend upon the presence of sugar contained in fruit.

Seeds:

Seeds are oval-cylindrical in shaped. Every fruit has single seed with a longitudinal channel. Seeds appear bright red to bright yellow in colour when unripe[9].

ECOLOGY

The plant date palm can resist high temperature for a long period of time but does not tolerate low temperature for very long time; below -8° is harmful for it. The appropriate conditions for growing date palm are low humidity region and where rainfall is very low. The most preferable circumstances for flowering are dry, long and hot environment. And a mean temperature is required for actual ripening like 30°-35°. The

date palm can grow in various types of soil and the alkalinity is between 5-8.2 pH ranges. Generally date palms are grown under providently controlled soaking[10].

PROPAGATION

The *P. dactylifera* normally build up either from seeds or from the cutting parts of the shoots. But currently researchers are focused on organogenesis for the growing of this by tissue culturing process. This technique is very helpful for farmers because from a very small amount of meristematic tissue large amounts of plants can be produced in a short period of time[10].

CHEMICAL CONSTITUENTS

The main chemical constituents of *P. dactylifera* are carbohydrates, steroids, flavonoids, alkaloids, vitamins and tannins. The chemical structures of various isolated chemical compounds from date palm are shown in Table 1[11-21] and fig. 2.

ETHNOMEDICINAL USES

The traditional uses of *P. dactylifera* are in Ayurveda also, its formulation used as tonic for the cure of Visarpa and Raktapitta. The fruit pulp of date is considered to be antitussive, expectorant, demulcent, laxative and diuretic. The date palm is also used for the relieving of alcohol induces detoxification. In Siddha system of medicine date palm powder is used for the treatment of dengue and influenza[22]. It is also use in some special case like convalescence from fevers and smallpox. The sweet date pulp is also use in dysentery. Date fruits are also useful for the treatment of asthma and headache. Those patients who are suffering from piles, they can use smoke of dates seed to get relieve from the pain. Dates fruits are also used as expectorant, cough relievers and to prevent constipation. Daily routine consumption of date fruits are helpful in ameliorating cough, rheumatism, burning sensation, nephropathy, bronchitis and sexual debility[23]. Roasted date seeds powder is used as main ingredient in "date coffee". The juice of the stem of dates palm has reported to have diuretic, demulcent and refrigerant activity in genitourinary infections. The spathe (liquid distillation) of *P. dactylifera* possesses anti-spasmodic activity. The flower of dates palm is used as a purgative. The pollen grains of *P. dactylifera* are responsible for the improvement of fertility in women. The daily intake of date palm pollen and the male flowers was believed to be an aphrodisiac and to enhance fertility. Dates are also given to infants with teething problems as are believed to harden the gums[24].

PHARMACOLOGICAL ACTIVITY

The pharmacological activities of *P. dactylifera* are shown due to its active constituents. The different chemical constituent shows specific activity like antioxidant potential of plant is due to flavonoid and analgesic activity due to alkaloids[25].

Hepatoprotective activity:

Al-Qarawi *et al.*[26] investigated the flesh and a pit of aqueous extract of *P. dactylifera* and found that it has ameliorative effect. The aqueous extracts of flesh

TABLE 1: PHYTOCONSTITUENTS REPORTED IN *P. dactylifera* Linn.

S. No	Type of chemical	Chemical constituents
1	Phenolic compounds	Coumaric acid, cinnamic acids and sinapic acid[11]
2	Flavonoid glycosides	Methyl luteolin, methyl quercetin, luteolin and quercetin[11]
3	Bound phenolic acids	Gallic acid, syringic acid, caffeic acid, p-hydroxybenzoic acid, vanillic acid, p-coumaric acid, o-coumaric acid, protocatechuic acid and ferulic acid[12]
4	Free phenolic acids	Vallic acid, ferulic acid, procatechuic acid and syringic acid
5	Flavones	Epicatechin and catechin[13]
6	Fatty acids	Palmitic acid, palmitoleic acid, linolenic acids, lauric acids, myristoleic acid, capric acids, and myristic acid[14]
7	Pigments	Anthocyanins[15]
8	Carotenoids	α-carotene and Lutein[16]
9	Steroids	Campesterol, cholesterol, stigmasterol, isofucosterol and ß- sitosterol[17]
10	Triterpenoid	α-amirin[18]
11	Enzymes	Peroxidase phytase and Invertase[19]
12	Vitamins	Vitamin A, B1, B2, B3, B5, B6, B9 and C[14]
13	Other constituents	Galactomannans α-D glucan and Heteroxylon[20,21]

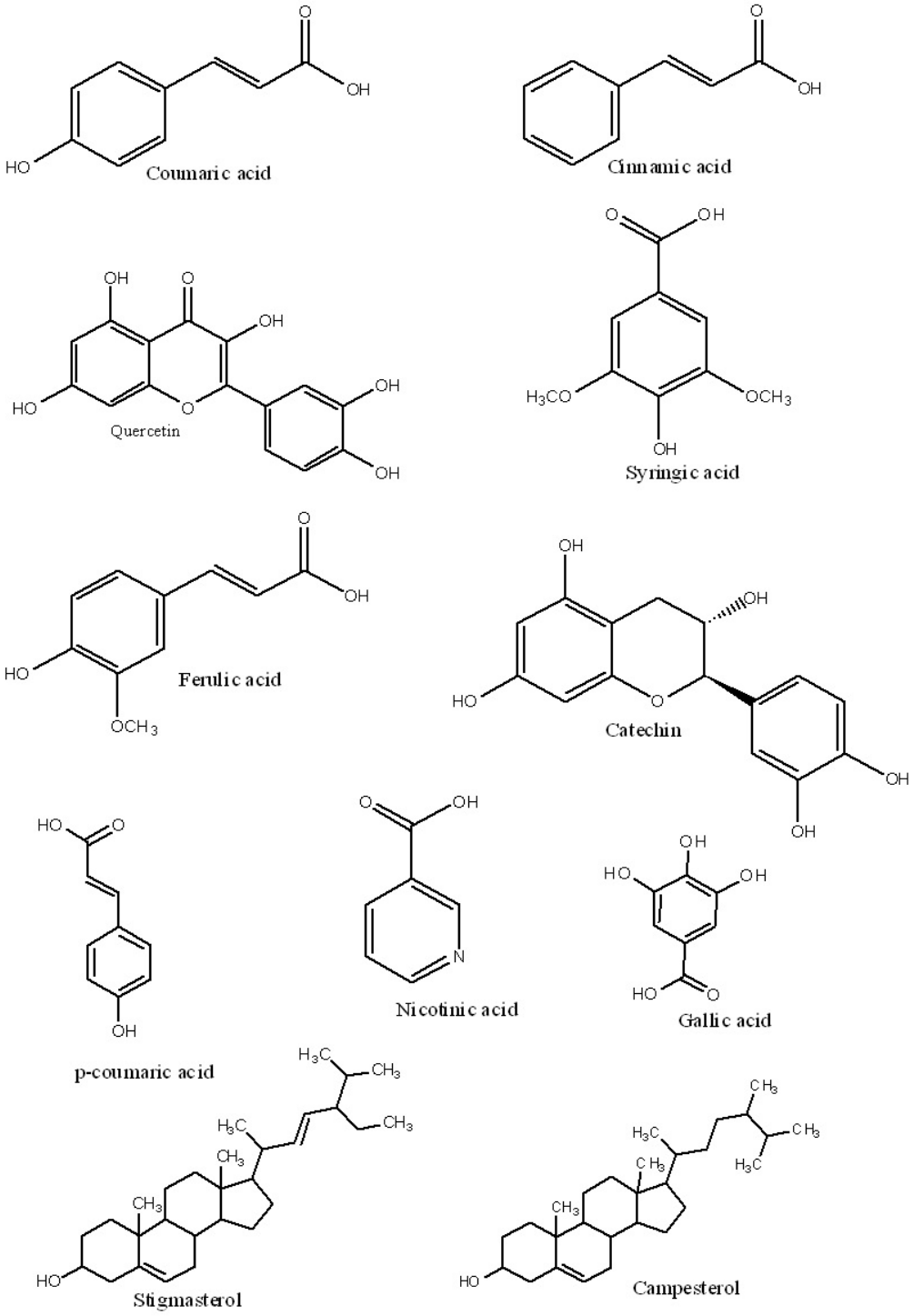

Fig. 2: Structures of chemical constituents of *P. dactylifera* Linn.

or pits of plant give the hepatoprotective activity at dose level of 0.2 ml/100 g against CCl_4 induced liver damage in rats. Ahmed *et al.*[27] studied that the aqueous extract of *P. dactylifera* give hepatoprotective activity at the dose level of 400 mg/kg against ascorbic acid on thioacetamide induced liver toxicity in rats.

Anti-bacterial activity:

Perveen *et al.*[28] investigated the methanol and acetone extract of leaves and pit of *P. dactylifera* which showed potent antibacterial activity, whereas water extract does not showed the significant antibacterial activity. Minimum Inhibitory Concentration (MIC) has been observed with methanolic extract of leaves and pit of date palm at a dose level of 1.3 mg/ml and 1.1 mg/ml and at a dose level of 1.6 mg/ml and 1.4 mg/ml acetone extract of leaves and pits showed the antibacterial potential. Aamir J *et al.*[29] studied that methanolic

extract of *P. dactylifera* seeds had the anti-microbial potential against *E. coli* and *K. Pneumonia* and from this study it was also concluded that methanolic extract also attenuated the side effect of prednisolone. Bokhari *et al.*[30] investigated that the *P. dactylifera* leaves extract has potential antifungal and antibacterial potential against *F. solani* and *F. oxysporum*.

Anti-ulcer activity:

Gangwar *et al.*[31] studied the *P. dactylifera* posseses the antiulcer activity. The chloroform extract of date palm leaves had shown antiulcer activity at the dose level of 200 and 400 mg/kg and the higher dose showed the potent antiulcer activity as compared with standard drug.

Anti-diabetic activity:

Michael *et al.*[32] studied *P. dactylifera* fruit extract used to treat alloxan induced diabetes in rats. From this studied it was concluded that the antidiabetic activity has been shown due to the presence of active phytoconstiuents i.e. flavonoid.

Anti-cancer activity:

Ishurd *et al.*[33] evaluated that glucagon has isolated from Libyan dates and from this studied it concluded that the purified form of glucagon shows potent anticancer activity.

Nephroprotective activity:

Al-Qarawi *et al.*[34] investigated that *P. dactylifera* had a potent nephroprotective potential. The flesh and pits extract of plant give potent nephroprotective activity against gentamicin induced nephrotoxicity. Thouri *et al.*[35] from the studies concluded that the dichloroacetic acid induced nephrotoxicity in wister rats were cured with 4 ml/kg dose level through the inhibition of Malondialdehyde (MDA) and Glutathione (GSH) levels. It was further also concluded that the plant also has the antioxidant potential.

Anti-inflammatory activity:

Zhang *et al.*[36] studied Ajwa variety of dates for anti-inflammatory activity. Methanolic, ethyl acetate and water extract were used in this studied. From this studied it was concluded that the plant has significant anti-inflammatory activity and also inhibited the Lipid Peroxidation (LPO). Mohamed *et al.*[37] also studied that methanolic extract of *P. dactylifera* fruit can be used for reducing the swelling of foot. And from this study it showed that the methanolic extract has significant anti-inflammatory potential. Eddine *et al.*[38] investigated that the leaves extract of dates has showed the potent anti-inflammatory as well as antioxidant potential.

Sedative activity:

Rahimi *et al.*[39] reported that hydro-alcoholic extract of *P. dactylifera* has shown the sedative effect. In this study Electroencephalogram (EEG) result showed that a dose level of 125 and 250 mg/kg were appropriate for maintaining the low and high frequency waves.

Treatment for delivery and labor relaxation:

Al-Kuran *et al.*[40] studied that *P. dactylifera* fruits can used safely during pregnancy. From the study it was seen that the date fruits significantly increased labor and dialated the cervical portion during pregnancy in women.

Treatment for Alzheimer's disease:

Hussain *et al.*[41] investigated that the leaves extract of *P. dactylifera* prevented the chemically induced memory loss using scopolamine and streptozotocin in mice at a dose level of 100, 200 and 400 mg/kg. The plant extract also has the antioxidant and neuro-protective activity. From this study it was concluded that the fruits have the potential activity to manage the Alzheimer disease.

Treatment for fertility and development of reproductive activity:

Moshfegh *et al.*[42] studied *P. dactylifera* for the purpose of male infertility as in traditional medication. The animals were treated with *P. dactylifera* pollen at dose level of 100 and 200 mg/kg. The several parameters showed that date palm pollen were effective in case of fertility and developed the reproductive system. From this it was concluded that the plant has significant effect in fertility and in reproductive system. Khalifa *et al.*[43] investigated the aqueous extract of *P. dactylifera* and found increase in the sperm quality and control in the oxidative level. Therefore, in this study aqueous extract of *P.dactylifera*, dose level of 10 and 20 ml/kg was used. Both dose levels increased the sperm quality by decreasing the abnormal sperm and increasing the number of living cell.

Treatment against cryptosporidiosis:

Mahmood *et al.*[44] investigated cryptosporidium infection that is dangerous and results in immunodeficient hosts. There is no appropriate medication for this

disease. Therefore, the aqueous extract of *P. dactylifera* had been used against immunosuppressed mice. After checking all the immunological parameter it concluded that it showed significant results after use of *P. dactylifera*.

CONCLUSION AND FUTURE PERSPECTIVES:

In recent years medicinal plants are used universally in the formulation of medicine for their greater medicinal uses and also for its minimum or less side effects. The medicinal plant also has several commercial aspects because it is highly safe for human beings. The *P. dactylifera* is a medicinal plant which is used conventionally for its greater therapeutic level due to its rich phytoconstiuents. Date palm is reported to contain various chemical constituents like alkaloids, mineral salts, and carotenoids. This review has revealed that date palm possess numerous pharmacological activities. An extensive research and development work should be undertaken on *P. dactylifera* and its products for proper investigation of its mechanism of action, toxicity profile, standardization and clinical studies so that better economic and therapeutic utilization can be achieved. The authors wish the review can provide valuable data for explorations and advanced researches on this valuable medicinal plant.

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Conflict of interests:

The authors declared no conflict of interest.

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