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A review of Indian date palm (*Phoenix sylvestris*) pharmacological activity

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***Abstract*:** Phoenix Sylvestris (Arecaceae family) is known as the Indian date palm, and it is identified as the main component of traditional medicine against various alignments. It has the nutritional value throughout the world. It is a rich source of phenols, amino acids, flavonoids, tannins, alkaloids, terpenoids, dietary fibers, vitamins, and minerals. Different parts of the plant exhibit the medical properties of antipyretic, cardiotonic, laxative, diuretic, and antioxidant.

***Keywords*:** Phoenix sylvestris, Arecaceae, Indian date palm, pharmacological properties

I. INTRODUCTION

Phoenix sylvestris (Sylvestris- Latin, of the forest) is also known as silver date palm, Indian date, sugar date palm or wild date palm. It is a species of flowering plant in the palm family native to southern Pakistan, most of India, Sri Lanka, Nepal, Bhutan, Myanmar, and Bangladesh. Growing in plains and scabland up to 1300m above sea level, the fruit from this palm species is used to make wine and jelly. The sap is tapped and drunk fresh or fermented into toddy. The fresh sap is boiled to make palm jaggery in West Bengal state of India and Bangladesh. Phoenix Sylvestris has been considered as traditional medicine to cure various ailments like abdominal complaints, fever, loss of consciousness [1].

The sap of plant- laxative and nutritious and cooling

Central tender part of the plant - in the treatment of gonorrhea

Root- treat toothache and nervous debility and helminthiasis, Dysentery

Fruit - cardiac tonic and restorative, and it's also used for backache and in the buttocks, male fertility and body strength

Heart wood - Increasing lactation

Gum-Diarrhea, Genitourinary

Juice of root seedling – fever

II. TAXONOMIC POSITION OF PHOENIX SYLVESTRIS

Kingdom	-	Plantae
Sub kingdom	-	Tracheobionta
Super division	-	Spermatophyta
Division	-	Magnoliophyta
Class	-	Liliopsida

Subclass	-	Arecidae
Order	-	Areales
Family	-	Arecaceae
Genus	-	Phoenix
Species	-	Phoenix Sylvestris (L.) Roxb

III. BOTANTICAL DESCRIPTION

Botanical Name: *Phoenix sylvestris*, Common Name: Silver Date Palm, Sugar Date Palm, Wild Date Palm. Morphological characters: Phoenix sylvestris ranges from 4 to 5 min height and 40 cm in diameter. The leaves are 3m long, gently recurved, on 1m petioles with acanthophyllia near the base. The leaf crown grows to 10m wide and 7.5 to 10m tall containing up to 100 leaves. The inflorescences grow to 1m with white, unisexual flower forming to a large, pendent infructescence. The single seeded fruit ripens to a purple - red color. Anthers are 3 to 4 mm long. It can grow in the pH range of 5.5 and it can tolerate pH range from 5.8. Fully matured *Phoenix Sylvestris* are known as drought adaptor. 8B-11 (Hardiness Zone), Slow to moderate growth rate, Survival Temperature: -5.5 °C/22 °F, Drought Tolerance: High Soil Tolerance: Moderate to High Salt Tolerance, Moderate to High Requirements, Adaptable to a wide range of situations high Light Requirements, Moderate nutritional requirements Specimen tree is one of the many uses for this tree. There are no major pest problems on the trunk or stem. Robust, with a diamond-shaped skirt of aerial roots at the base and persisting leaf bases above. Pinnately complex, induplicate; lower leaflets converted into spines; 200-250 leaflets grouped in groups of two or three, often crossing. Canopy with 100 leaves measuring 9–12 feet in length. Color of the foliage: blue-green Leaf length: 9-12'; leaflets:.5-1.5' long, 1" broad 3' long petiole with armed with spines of leaflets, Crown-shaft: There isn't one. Inflorescence: 2-3" long, branching, and borne among the leaves inflorescence separate male and female plants by gender. Trees can reach a height of up to 40 feet [4]. Full sun exposure sun Danger. This plant bears spines or sharp edges; handle with extreme caution. Late spring/early summer is the best time to plant. Color of bloom- cream/tan from seed, germinate in a damp paper towel, and from seed, germinate in vitro in gelatin, agar, or another media. Before storing seeds, remove the fleshy layer on them. The seed can be successfully kept if it is properly cleansed. pH needs for soil: 6.1–6.5 (mildly acidic); 6.6–7.5 (neutral); 7.6–7.8 (acidic) (mildly alkaline).

Fig. 1. Shows the image of *Phoenix sylvestris.*

IV. PHARMACOLOGICAL ACTIVITY

Various medicinal properties are identified in *Phoenix Sylvestris* are

1.Antimicrobial activity

2. Antidiarrheal activity

3. Anti- diabetic activity

4.Anti-inflammatory activity

5.Anti-ulcer activity

6.Antioxidant activity

7.Antinoceptive and pharmacological activity

8.Anti-mutagenic activity

9. Anti-obesity

10.Anti-cancer activity

11. Diuretic activity

12.Hematopoietic activity

13. Hepato protective activity

14.Effect on hemolytic activity

15.Effect on reproductive system

1. Antimicrobial activity

S AI- Daihan *et al* (2012). In this article, it explains that the antimicrobial activity against microorganism (*Staphylococcus aureus*, *Streptococcus pyrogen*, *Escherichia Coli*, and *pseudomonas aeruginosa*. *Phoenix Sylvestris* was extracted by using water, methanol, and acetone. The antimicrobial activity was estimated by using the disc diffusion method. Finally, the extract revealed that, they have highest antibacterial activity against tested microorganism and zone of inhibition is measured [2].

Table 1. Antimicrobial activity of phoenix Sylvestris seed extract against bacterial species tested by disc diffusion method.

Zone of inhibition (mm)				
	Gram + bacteria		Gram - bacteria	
Plant extract	S. aureus	S. pyogenes	E. coli	P. aeruginosa
Pit				
AQ	10 ± 0.00	8 ± 0.63	9 ± 0.22	9 ± 1.15
ME	11 ± 0.89	10 ± 0.19	11.5 ± 0.00	11.5 ± 0.66
AC	11.60 ± 0.88	9.00± 0.20	11 ± 0.50	11 ± 00

Values are mean inhibition zone (mm) S.D of three replicates. AQ - aqueous, ME - methanol, AC- acetone

Kothari V *et al* (2011). The author investigated that the in vitro antibacterial activity against few gram-positive bacteria and gram-negative bacteria. The extraction is done by using methanol , ethanol and chloroform by microwave assisted extraction method .The antibacterial activity was investigated by using disc diffusion and broth dilution method .Finally ethanol extraction have antibacterial activity against both gram+ and gram- organism with MIC (minimum inhibitory concentration) values of 481 and 410 mu g/ ml against *Salmonella paratyphi A* and *Salmonella paratyphi B* epidermis .This article indicates various extract of *phoenix Sylvestris* seed possess antibacterial activity [3].

Sumera perveen *et al* (2016). This article explains that the antibacterial and antifungal activity in crude extract of *Phoenix sylvestris* leaves. First the crude extract of leaves was done by using four different solvents (methanol, ethyl acetate, butanol, and n- hexane). Antibacterial and antifungal activity was tested by agar tube dilution and agar well dilution method against *P. aeruginosa*, *E. Coli*, *S. typhi* and *B. subtilis.* Finally, the plant extraction has the antimicrobial activity [4].

2. Antidiarrheal activity

Agbon AN *et al* (2013*). Phoenix dactylifera* (date palm) extracts are commonly utilized in traditional medicine is used to treat a variety of ailments. The antidiarrheal activity of the aqueous solution was investigated in this study. Castor oil-induced diarrhea, enteropooling, and the effects of *Phoenix dactylifera* fruit extract were examined. Wistar rats' gastric motility activity. The extract (1000 and 2000 mg/kg loperamide) is like the normal medicine (5 mg/kg loperamide). The severity of diarrhea was significantly reduced when the dose was increased to 1500mg/kg body weight. The extract reduced the frequency of defecation and gastrointestinal motility in a significant (p0.05) way. The extract supplied at 1000mg/kg demonstrated a stronger anti-enteropooling effect than the standard medication (5mg/kg) in the enteropooling research loperamide). The findings suggest that the aqueous fruit extract of *Phoenix dactylifera* may contain some antioxidants compounds with antidiarrheal effects that are pharmacologically active. This could be the starting point for managing the situation, gastroenterological problems [5].

Table 2. Effect of Phoenix dactylifera L fruit extract on castor oil induced diarrhea in Wistar rats.

Group treatment	**Number of wet feces**	**% Inhibition of defecation**
Distilled water (1 ml/kg) phoenix dactylifera L	5.00+0.00	-
(1000 mg/kg) Phoenix dactylifera L.	3.80+0.73	24*
(1500 mg/kg) Phoenix dactylifera L	2.40+0.24	52***
(2000 mg/kg) Loperamide hydrochloride	4.40 +024	12
(5 mg/kg)	2.40+0.24	52***

n = 5, values are means± SEM; * = p<0.05; *** = p<0.001; Significant difference when compared with the control using LSD test

Megbe BC *et al* (2017). The primary goals of this study were to determine the proximate nutritional composition and antidiarrheal activity of *Phoenix dactylifera*. aqueous fruit extract (date palm). Loperamide was used to test the antidiarrheal activity of the *Phoenix dactylifera* aqueous fruit extract on castor oil-induced diarrhea in male Wistar rats. The antidiarrheal activity of the aqueous fruit extract was found significant (P < 0.05) at 1000 mg/Kg and 2000 mg/Kg body weight. The result of this research showed that *Phoenix dactylifera* L. (date palm) fruit can be used as an effective nutraceutical in the management and treatment of diarrhea [6].

3. Antidiabetic activity

Abiola T *et al* (2018). The goal of this study was to explore if the ethanolic extract of date palm seed could help diabetic rats who had been given alloxan. Standard methods were used to establish the approximate content of date palm seed. The crude extraction process was used to prepare an ethanolic extract of date palm seed. The seed extract's total flavonoids, phenolic content, and total antioxidant capacity were assessed. When comparing the diabetic treatment groups to the diabetic control group, there was a substantial (P0.05) drop in LDL, VLDL, cholesterol, triglyceride, and blood glucose levels, but no significant (P>0.05) rise in HDL. A substantial increase (P0.05) was observed [7].

Melek RH *et al* (2019). In Egypt, *Phoenix dactylifera* seeds are commonly used to cure diabetes (DM). In male albino rats, the antidiabetic efficacy of aqueous methanolic seed extracts from two cultivars of *P. dactylifera*, Sammany (PDSE) and Hayany (PDHE), was examined in streptozotocin (STZ)-induced DM. After a single injection of STZ (52.5 mg/kg, i.p.), the PDSE and PDHE at doses of 70, 140, and 280 mg/kg b.w, as well as gliclazide (10 mg/kg b.w.) were administered separately for 14 days. The STZ-induced group received a dose of 280 mg/kg b.w. of PDSE and PDHE, which resulted in a 55.4 percent and 56 percent reduction in serum glucose, respectively [8].

Priya S (2018), in this study, the anti-diabetic efficacy of leaves extract was tested in vitro using four different solvents: petroleum ether, chloroform, ethyl acetate, ethanol, and distilled water. Controlling the inappropriate postprandial increase in blood glucose level is one way to prevent diabetes. Inhibition of carbohydrate hydrolyzing enzymes such as -amylase and -glycosidase can accomplish this. The -amylase inhibitory assay and the non-enzymatic glycosylation of haemoglobin technique were used to evaluate the leaf extracts. The ethanolic extract had stronger anti-diabetic action than the other extracts in both approaches [9].

Ahmed S *et al* (2017), changes in eating patterns, sedentary lifestyles, and rising stress levels are all factors that contribute to the high prevalence of diabetes mellitus. Diabetic problems frequently lead to cardiovascular illnesses, hypertension, and hyperlipidemia, which are the world's leading causes of death and disability. *Phoenix dactylifera* (date palm) has been used for

various diseases in the past, but its potential as a therapeutic food is still unknown. The results of this study show that Aseel dates have considerable anti-hyperglycemic benefits in diabetes treatment, although more preclinical and clinical research is needed to confirm this [10].

Table 3. Composition and mineral profile of date variety Aseel.

Parameter	Proximate quality
Moisture (%)	7.2 ± 0.34
Ash (%)	2.19 ± 0.05
Crude protein (%)	41.25 ± 2.05
Crude lipid (%)	9.05 ± 0.42
Carbohydrates (%)	40.22 ± 2.01

Mohieldein A *et al* (2015). In diabetes-induced rats, the anti-diabetic, hypolipidemic, and antioxidative effects of date seed extract were investigated. There were seven groups of rats: control rats, streptozotocin-induced diabetic rats, and diabetic rats treated with aqueous seed extract at a concentration of 100g/L at a dose of 10ml/day/rat. To determine the anti-diabetic property, glucose and weight were measured weekly, and all rats were slaughtered at the end of the eight-week period. Serum cholesterol, triglyceride, malondialdehyde, superoxide dismutase, and 8-hydroxy-2'-deoxyguanosine were measured to assess the hypolipidemic and antioxidative actions. With both seed extracts of Ajwa and Sukkari dates, there were substantial variations in the analyzed clinical chemistry and oxidative stress parameters between diabetic and control rats [11].

4. Anti-inflammatory activity

Mukherjee K *et al* (2014). *Phoenix sylvestris* L is an anti-geriatric and antioxidant ethnomedicine that is edible. In this study, three different types of date palm extracts, methanolic, acidic ethanolic, and basic ethanolic, were evaluated for their potential in vitro scavenging effects on reactive oxygen species (ROS), including hydroxyl radicals (basic ethanolic>acidic ethanolic>methanolic), superoxide radicals (acidic ethanolic>basic ethanolic>methanolic), and DPPH radicals (acidic ethanolic>basic nitric oxide (NO)] (ethanolic). Date palm extracts applied therapeutically decrease intracellular oxidative stress in human embryonic kidney cell line (HEK) and murine RAW macrophages generated by bacterial lipopolysaccharide (LPS) [12].

Bharathi V *et al* (2019). The medicinal value of *Phoenix pusilla* is unknown. The antioxidant capacity, α-amylase, and α-glucosidase inhibitory effect of ethanol root extract was investigated in this work. Two invitro approaches were also used to assess the anti-inflammatory potential. The extract's IC50 values against enzymes revealed. At low concentrations, the capacity to reduce glucose levels (postprandial). The inhibitory effect was significant against α- glucosidase than towards α-amylase. Anti-inflammatory assays showed 88.62 percent and 67.51 percent, respectively of restraint. As a result, an in vitro investigation demonstrated that the root extract had the ability to combat free radicals hypoglycemic and anti-inflammatory properties [13].

Table 4. Anti -inflammatory Activity of *Phoenix pusilla* ethanolic Extract by Proteinase Inhibitory Method.

Concentration µg/ml	% of inhibition of Standard	% of inhibition of Standard
200	16.94	29.73
400	25.99	48.80
600	48.48	61.41
800	63.67	77.63
1000	73.37	88.62
IC 50 Value	657.26	446.695

Saryono S *et al* (2018). To investigate the anti-inflammatory activities of date seed extract and the mechanism of action in carrageenan-induced edema in rats. 30 Wistar rats were divided into six groups in this study with a pre- and post-test control group design: groups C1, C2, and C3 (given 1, 3, and 5 g/kg of soaked date seeds, respectively); positive control (PC, positive control given dexamethasone, 0.5 mg/kg dose); negative control (NC, edema induced by carrageenan); and healthy control. It was discovered that soaked date seeds suppress pro-inflammatory mediators in a similar way to dexamethasone, which was used as a positive control [14].

5. Antiulcer activity

Gandhimathi and Sreedevi (2012). Tested the anti-ulcer activity of the ethanol extract of root of *P. sylvestris Roxb.* (EPS) in albino rats using ethanol, indomethacin, pyloric ligation, and cold-restraint, stress-induced gastric ulcer models (2012). Using a cytoprotective mechanism, an ethanol extract of the root of *P. sylvestris Roxb*. showed anti-ulcer properties. In all four models, EPS at dosages of 200 mg/kg and 400 mg/kg resulted in a significant reduction in ulcer severity. (15)

Gangwar AK *et al* (2014), considering this, we investigated the ulcer-healing properties of Phoenix dactylifera leaves. The anti-ulcer effect of Phoenix dactylifera leaves was investigated in Wistar rats by pylorus ligation. By pylorus ligation, chloroform extract of Phoenix dactylifera leaves at two doses, 200 and 400 mg/kg, were assessed using Ranitidine (50 mg/kg) as standards. In the pylorus ligation approach, the standard and test medications were given orally for three days. pH, gastric content, free and total acidity can all be used to determine the gastroprotective potential. The current study found that a chloroform extract of Phoenix dactylifera leaves has gastroprotective activity, as shown by a substantial reduction in mean ulnar pressure [16].

6. Antioxidant activity

Das S *et al* (2016), following a metabolomics method, methanol extract and extracts after alkaline hydrolysis of the mesocarp tissue of full-mature edible fruits of *P. sylvestris* were examined by GC-MS. The antioxidant and inhibitory characteristics of the fractions were tested against the two major enzymes involved in diabetes, α-amylase, and α-glucosidase. In the methanol extract and fractions following saponification, a total of 71 metabolites were discovered, including organic acids, amino acids, sugars, sugar alcohols, fatty acids, and phenols. Antioxidant, α-glucosidase, and α-amylase inhibitory activity were all high in all extracts and fractions. The metabolites found in the fruit mesocarp tissue were found to have antioxidant activity and characteristics, according to this study [17].

Table 5. Antioxidant properties of *P. sylvestris* mesocarp extracts and metabolites.

Antioxidant activity			
	DPPH radical	Superoxide radial	
Extract /Metabolite	IC50 value (mg/ml) /[mM]	IC50 value (mg/ml) /[mM]	TAC (AAE
FM	0.14 ± 0.001	0.55 ± 0.20	0.66
SI	0.27 ± 0.003	0.45 ± 0.02	0.08
4-Hydroxycinnamic acid	-	0.51 ± 0.05	-

7. Antinociceptive and pharmacological activity

Shajib MS *et al* (2015). the goal of this investigation was to see if a methanol extract of *P. sylvestris* fruit pulp has antinociceptive and neuropharmacological properties (MEPS). Heat-induced (hot plate, tail immersion test) and chemical-induced pain models were used to assess MEPS' antinociceptive activity (acetic acid-induced writhing, formalin-induced nociception, glutamate-induced nociception, and paw edoema test). At all experimental doses, MEPS showed strong, substantial, and dose-dependent antinociceptive action in all heat-induced and chemical-induced pain models. The findings support the ethnomedicinal use of the fruit of *P. sylvestris* in a variety of painful illnesses and CNS diseases [18].

8. Anti-mutagenic activity

Vyawahare N *et al* (2008), on Salmonella tester strains TA-98 and TA-100 with metabolic activation, date fruit extract inhibited benzopyrene-induced mutagenicity in a dose-dependent manner. In TA-98 and TA-100, extracts from 3.6 mg/plate and 4.3 mg/plate were found to be necessary for 50% suppression of His+ revertant production, demonstrating substantial antimutagenic activity 31 [19].

9. Anti-obesity activity

Alloche FM *et al* (2016). The purpose of this study is to assess the polyphenolic composition of four Tunisian date palm varieties as well as their biological activity. Methanol extracts of date pits had the highest total phenolic content values. Furthermore, our research showed for the first time that pits from diverse date palms, particularly the Kenichi species, have a powerful inhibitory effect on key enzymes linked to diabetes and obesity. As a result, date palm pits might be regarded a powerful natural remedy source for high-value items that can be used in the agro -food, cosmetics, and pharmaceutical industries as a substitute for harmful synthetic chemicals [20].

10. Anticancer activity

Lamia FS *et al* (2021). The aqueous extract of Ajwa dates (*Phoenix dactylifera)* was discovered to improve liver function by restoring antioxidant enzymes, liver enzymes, cytokines balance, and gene expression to normal levels. Because the treatment and prognosis of Hepatocellular carcinoma, one of the main causes of cancer-related deaths worldwide, is improved when the patient's liver function is preserved. As a result, in this review, we discussed the possibility of isolating potential anticancer agents from the extract of these fruits, which could then be used as an indigenous substance for the treatment of hepatocellular carcinoma [21].

Khan F *et al* (2021), to test this hypothesis, we used a rat model of diethylnitrosamine (DEN) induced liver cancer to assess the HCC inhibitory effects and other positive features of the aqueous extract of ajwa dates (ADE). The reversion of DEN-damaged liver to normal was aided by ADE. The return to normal levels of antioxidant enzymes, liver enzymes, cytokines balance, and gene expression after ADE treatment suggests that ADE improves liver function and suppresses HCC. As a result, ADE can be administered in conjunction with other HCC treatments [22].

11. Diuretic activity and analgesic activity

Howlader *et al* (2006), tested the analgesic and diuretic effects of a methanol extract of *P. sylvestris* roots on Swiss albino mice (2006). At doses of 150 mg/kg and 300 mg/kg body weight, respectively, the extract significantly (p0.001) reduced the percentage inhibition of writhing generated by acetic acid (0.5 percent v/v). At 150 mg/kg and 300 mg/kg body weight in rats, the extract showed a diuretic effect at the 1st, 2nd, and 4th hours. The diuretic impact started sooner at 300 mg/kg body weight than it did at 150 mg/kg body weight. Similarly, the analgesic properties of an ethanolic extract of *P. padulsa* leaves were investigated in acetic acid-induced writhing in mice [23].

12. Hematopoietic activity

SN Onuh *et al* (2012).The purpose of this study was to look into the haemopoietic activity of *Phoenix dactylifera* (P. dactylifera) crude fruit extract and its effect on peripheral blood parameters .In both the aqueous and methanolic extracts, there was a substantial rise in Absolute values, Red Blood Cell (RBC), Haemoglobin (Hb), Packed Cell Volume (PCV), Reticulocytes, and Platelet count when compared to the controls (p0.05, p0.001). When compared to controls, total and differential white blood cell counts, as well as bone marrow examination, did not differ substantially (p>0.05) [24].

13. Hepato protective activity

Okwuosa C *et al* (2014), the purpose of this study was to assess the hepatoprotective potential of methanolic fruit extracts of *Phoenix dactylifera* (date palm) against thioacetamide-induced liver damage in male albino Wistar rats. In rats, the fruit of *Phoenix dactylifera* has an oral LD50 of >6000 mg/kg. In the TA-treated groups, there was a significant increase in the levels of biochemical markers of liver injury such as ALT, AST, ALP, and total bilirubin, as well as a decrease in albumin [25].

Singh A *et al* (2019), the effect of Phoenix sylvestris extract was investigated. In mice, paracetamol caused hepatic injury. The mice were given a treatment. It was discovered that extract of Phoenix sylvestris (100 mg/kg body weight) to protect mice from the hepatotoxic effects of paracetamol. Studies on the histopathology of the liver revealed a significant reduction in fatty degeneration and mice given dosages of Phoenix sylvestris extract with centrizonal necrosis. Mice were given extract as part of the study, serum enzyme activity and normal livers both exhibited a considerable drop. It has been noticed [26].

Abdelaziz DHA *et al* (2014), yhe purpose of this study was to examine if the aqueous suspension of Phoenix dactylifera L. seeds could protect rats from chemically induced hepatic damage. Wistar rats were given CCl4 (10 percent in olive oil; 0.5 mL/rat; IP) twice a week for four weeks to induce liver injury. Aqueous solutions of raw or roasted *Phoenix dactylifera* seeds (1.0 g/kg) were given orally along with CCl4 on a regular basis. *Phoenix dactylifera* seeds reduce the incidence of liver lesions (including vacuolization and fibroblast growth) caused by CCl4 poisoning, according to histopathology. *Phoenix dactylifera* seeds may be a good candidate for CCl4-induced liver intoxication protection, and this hepatoprotective effect could be due to antioxidant and free radical scavenging capabilities [27].

14. Effect of hemolytic activity

Abuharfeli NM *et a*l (2008), *Streptococcus pyogenes* was tested in vivo and in vitro using date fruit extracts from *Phoenix dactylifera* (Arecaceae). Incubation with date fruit extract at 5, 10, and 20% dilution for 24 hours effectively slowed *S. pyogenes* growth to 30.8 %, 64.7 %, and 88.5 % respectively. At very low concentrations, date extract (DE) abolished the hemolytic action of the streptococcal exotoxin streptolysin O. At a dilution of 1:262144 DE, 96 percent inhibition was obtained. Deproteinization of DE did not reduce the inhibitory action, indicating that the inhibitory ingredient is steroidal in origin rather than proteinaceous. The findings revealed that this fact has a neutralizing property [28].

15. Effect of reproductive system

Tahvilzadeh M *et al* (2015), DPP (date palm pollen) is the male reproductive dust of palm blooms that has long been utilized as a food supplement, particularly as an aphrodisiac and fertility enhancer in both women and men. Various experimental research on the reproductive benefits of DPP have been undertaken, even though there are few clinical trials testing the positive effects of DPP in humans. Amino acids, fatty acids, flavonoids, saponins, and estroles are among the chemicals extracted from DPP. The current review compiles a wealth of knowledge on DPP's phytochemistry and pharmacological activity, as well as its use in reproductive issues [29].

Moshfegh F *et al* (2015), the *Phoenix dactylifera*, also known as date palm pollen (DPP), is commonly used to treat male infertility. The goal of this research was to see how DPP affected fertility and the development of the female reproductive system in Balb /C mice.2 control and 8 experimental groups were divided into ten groups. The control groups 1 and 2 received no therapy, but the control group 2 mice were mated after 10 days. DPP (100 and 200 mg/kg, respectively) was given to the mice in experimental groups 1 and 2.10 days of oral administration The percentage of mating in experimental groups 3 and 4 was assessed.10 days later DPP was given to experimental groups 5 and 6 during pregnancy. Embryos were taken out to determine the histology of the ovaries DPP was given to experimental groups 7 and 8 until the 21st day. The first day after birth. The ovaries of the offspring were removed to assess histopathological characteristics. The findings of our study suggest that DPP can promote oogenesis and maintain effective fertility in female mice, suggesting that it could be used as a nutraceutical for fertility potentiation in future human investigations 30)

V. BIOACTIVE COMPOUNDS

In *Phoenix sylvestris*, Alkaloids, flavonoids, glycosides, steroids, and other bioactive substances are found. It has a vital role in medicine and disease treatment. Phytochemical screening methods and GCMS analysis are used to identify these bioactive chemicals.

1. Phytochemical analysis of fruit

Saha S *et al* (2017), In this article, the different solvent extracts (methanol, ethanol, acetone and water were used for the identification of bioactive compounds which include

1.Tannins

2.Flavonoids

3.Saponins

4.Alkaloids

Table 6. Phytochemical screening of different extract of *P. sylvestris* fruit [31].

Solvents	Alkaloids	Tannins	Flavonoids	Saponins
100% H_2O	-	-	+	-
50% Methanol	-	+	+	++
70% methanol	-	-	+	++
100% methanol	-	+	+	-
50% ethanol	-	+	+	++
70% ethanol	-	++	+	++
100% ethanol	-	++	+	+
50% acetone	-	++	+	-
70% acetone	-	+++	+	+
100% acetone	-	+	+	-

Rapaka G *et al* (2016), The author explains the phytochemical evaluation in *Phoenix sylvestris* fruit extract at two ripening stages. First the extract was done by using methanol. The qualitative analysis of phytochemical revealed the presence of various amount of

1.flavonoids

2.tannins

3. Phenolic content

The phytochemicals were significantly higher in the unripened stage than the ripened stage [32].

Table 7. quantitative analysis of different phytochemicals of *p. sylvestris* fruit extracts.

Fruit pulp of *Phoenix Sylvestris*	Total Phenol (mg GAE/gm FW) Extract	Total Tannin (mg TAE/gm FW Extract	Total Flavonoid (mg QE/gm FW) Extract
Ripened	5.39±0.72	10.54±1.84	24.93±1.12
Unripened	8.76±0.41	48.17±1.32	61.6±0.90

2. Phytochemical analysis of root

Pradeep A (2020), In this study, the author examined the phytochemical analysis in the crude extract of *phoenix pusilla* root were analyses by the GC-MS analysis. The result shows the presence of

1.Total phenolics

2.Tannins

3.Total flavonoids

Table 8. Quantification of secondary metabolites [33].

Secondary metabolites	Sample weight (mg/g dw)
Total phenolics	28.54 ± 0.16
Tannins	6.74 ± 0.24
Total flavonoids	8.21 ± 0.22

3. Phytochemical analysis of leaf

Hifnawy MS *et al* (2016), preliminary phytochemical screening of the plant's (*Phoenix canariensis)* leaves and pollens revealed the presence of

1. flavonoids

2. saponins

3.tannins

4. carbohydrates or glycosides

5.triterpenes or steroids

Table 9. Quantification of different chemical classes of plant constituents [34].

Natural compounds	leaves (in mg/g)	Pollen grains (in mg/g)
Polyphenolics	69.90	29.98
Flavonoids	23.86	17.20
Tannins	55.18	3.31
Steroids	2.60	12.40

4. Phytochemical analysis of seed

Sundar RDV *et al* (2017), biochemical assays were used to perform qualitative phytochemical screening on date seed powder. The phytochemical composition of the extract was determined using gas chromatography-mass spectrometry (GC-MS). The bioactive compounds which is present in it is

1.phenolics

2.tannins

3. flavonoids

4. sterol and triterpenes,

5.alkaloids

6. saponins

7.anthraquinone glycoside

Table 10. Qualitative Phytochemical composition of date seed powder [35].

Phytochemicals	Inferences
Flavonoids	+
Tannins	+++
Saponins	+++
Phenol	+++
Alkaloids	++++
sterol and triterpenes	+++
7.anthraquinone glycoside	-

5. GC- MS analysis in date palm seed

Sharma DC *et al* (2016), GC-MS analysis of the most powerful MPF8 revealed the presence of eight chemicals. Tetradecanoic acid, 2,6,10-Trimethyl,14-ethylene-14-pentadecene, Pentadecanoic acid, 2,4-Dimethoxybenzyl acetate, 2-hexadecen-1-ol, 3,7,11,15-Tetramethyl, 9-Octadecanoic acid, 2,4-Dimethoxybenzyl acetate, 2-hexadecen-1-ol, 3, depicts their % area and relative retention time. The synergistic effect of all the chemicals resulted in antioxidant, antibacterial, and other properties. In the GC-MS analysis, pentadecanoic acid had the highest percent area (52.90) and was previously found as having substantial anti-inflammatory, antibacterial, and anti-cancerous activity, whereas other substances were possessed strong protecting and curing properties, as discovered in a GC-MS analysis [36].

Table 11. GC-MS compounds and their area of P. sylvestris MPF8 extract.

Peak	R time	Area	Name
1	13.299	9.30	4-methyl -2,5-dimethoxy benzaldihyde
2	15.396	7.90	Tetradecanoic acid
3	16.226	7.63	2,6,10- trimethyl,14-ethylene-14-Pentadecane
4	17.487	52.90	Pentadecanoic acid
5	17.966	6.53	2-4- dimethoxy benzyl acetate
6	18.957	6.46	2-hexadece 1-ol, 3,7,11,15- tetramethyl (R)
7	19.174	4.58	9-octadecanoic acid
8	19.366	3.98	Octadecanoic acid

VI. CONCLUSION

P. sylvestris is thought to have therapeutic characteristics and has been used to treat abdominal pain, fevers, loss of consciousness, constipation, heart problems, toothaches, nervous debility, and helminthiasis. The phytochemical, pharmacological, and traditional uses of the wild date palm were the subject of this review (*Phoenix sylvestris Roxb*.). The plant has a lot of pharmaceutical activities.

VII. REFERENCES

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