IJBPAS, December, 2022, 11(12): 5864-5877

ISSN: 2277–4998

International Journal of Biology, Pharmacy and Allied Sciences (IJBPAS)

'A Bridge Between Laboratory and Reader'

www.ijbpas.com

A REVIEW: TRADITIONALLY USED MEDICINAL PLANTS OF FAMILY ARECACEAE WITH PHYTOCONSTITUENTS AND THERAPEUTIC APPLICATIONS

SHUKLA A AND DUBEY S*

Department of Chemistry, Gurukula Kangri (Deemed to be University) Haridwar - 249 404, uttarakhand India

***Corresponding Author: Supriya Dubey: E Mail: supriyadubey2998@gmail.com**

Received 26th Dec. 2021; Revised 25th Jan. 2022; Accepted 12th March 2022; Available online 1st Dec. 2022

https://doi.org/10.31032/IJBPAS/2022/11.12.6655

ABSTRACT

Plant-based procedures continue to play an vital role in health protection, and their use by individual civilization has been astronomically reported. The plants of the Arecaceae family composed of about 181 genera and 2600 species mainly distributed in tropical and sub tropical ecological zones as well as in the Arabian deserts and throughout the continents of Africa, Latin America , South and South- East Asia and has been habitually used for treatment of several diseases . The present study aimed to provide a general review of the available literature on ethanomedical, phytoconstituents, and biological data related to the Family Arecaceae as a potential source of new compounds with therapeutic applications. Considering Traditional uses, in the treatment of various gastrointestinal diseases, killing parasites, curing kidney asthenia, tinnitus, diarrhea treatment, amenorrhea, venereal diseases etc. phytochemical studies, flavonoids, fatty acids, carotenoids, spirostan, terpenes, amino acids , tannins ,alkaloids and phenolic acids were the main classes of compounds identified in roots, leaf, fruit and seeds which were correlated with their biological activities as anti-microbial, anti-fungal, anti-parasitic, anti-allergic, antidiabetic, antineoplastic, anti-inflammatory or antioxidant agents.

Keywords: Family Arecaceae, Traditional and medicinal importance, phytoconstituents, Therapeutic applications

INTRODUCTION

Family Arecaceae in the order Arecales a monotypic family. It has around 181 genera and 2600 species **[1]**. Arecaceae plant family containing species of tropical climbers, shrubs and trees commonly known as Palm trees or simply Palms **[2]**. Many species of family Arecaceae are mainly distributed in tropical and sub tropical ecological zones also in the Arabian deserts and throughout the continents of Africa , Latin America , South and South- East Asia **[3]**. The leaves, barks, roots, branches, fruits, endocarp, fiber, seed coat, sap, spadix, and heartwoods are used as the traditional medicines. In India Family Arecaceae is reported 225 species belonging to 25 genera **[4]**. These species are used in many herbal and conventional medicines in India and China because of their good response in many therapeutic applications. Species of Arecaceae family are traditionally used as the treatment of various gastrointestinal diseases, killing parasites, curing kidney asthenia, tinnitus, diarrhea treatment, amenorrhea, venereal diseses etc. *Arecaceae* family has reported the presence of phenolic acids, fatty acids, carotenoids, amino acids, tannins, flavonoids, steroids, terpens, and alkaloids **[5]**. Many species of *Arecaceae* family are reported for anti-inflammatory, antidiabetic, antioxidant, anti-parasitic, antimalarial, antineoplastic, antiprotozoal, hepato-protective, Enzyme inhibition, Remediation activity, antifungal, anti-proliferative and antibacterial activity **[6]**. Some important species of this family are *Cocus nucifer, Areca catechu, Caryota mitis, Phonix dactylifera, Washingtonia robusta, Serenoa repens, Borassus flabellifer, Caryota urens , Livistona chinesis, Archotophoenix alexandrae, Rhapis excels*, *Dypsis lutescens* , *Washingtonia filifera* and *Roystonea regia* etc. **[7]**.

TRADITIONAL USES OF SOME PLANTS OF FAMILY ARECACEAE

The plants species of Arecaceae family have been associated to claims of various medicinal properties and wide-ranging applications in traditional and modern medicine alike.

Traditionally, the plants are used to treat inflammation, pain, cancer, and bacterial and viral-based infections. Furthermore, the Arecaceae family species are stomatitis, ulcers, reducing blood pressure, blood lipids, hypertension, coronary heart diseases and wounds while also acting as an antioxidant **[12]**, anti-allergenics, antimicrobials **[13]**, antiviral **[14]**, antitumor and antidiabetic **[15]** alternative .They are also applied to tend to cases of Indigestion, bloting a, constipation

and amenorrhea, besides possessing sedative and laxative properties obtained fr the extract of their root ,leaf and barks **(Table 1)**.

PHYTOCONSTITUENTS PRESENT IN FAMILY *ARECACEAE*

The phytochemical analyses done for several species of family Arecaceae have revealed the positive presence of alkaloids, flavonoids, phenolic acids, tannins, amino acids, triterpenes, steroids and carotenoids **(Table 2)**.

BIOLOGICAL ACTIVITIES OF DIFFERENT SPECIES OF FAMILY *ARECACEAE*

The family Arecaceae is the target of different pharmacological investigations, which is evaluated for their various ethno-medicinal uses. From the literature, it was found that *Arecaceae family* exhibit an extensive variety of biological activities, such as antibacterial, antiviral, anthelmintic, anti-inflammatory, antioxidant, antiplasmodial, anti-allergy, anti-tumour, cognitive activity and cytotoxicity. The active phyto-constituents have been isolated from the solvents like ethanol, butanol, n-hexane, chloroform, acetone, ethyl acetate, dichloromethane, etc. followed by characterization. A summary of the curative activity assessments performed on this Arecaceae has been represented in **Table 3**. These findings endorse the traditional uses of plants with respect to the pharmacological activity **(Table 3)**.

Table 1 : Traditional uses of family Arecaceae

Botanical Name	Common Name	Traditional use	Refrences
Areca catechu	Areca palm, Betel palm, Indian nut.	Areca nut -is commomly used as the treatment of various gastrointestinal diseases. Killing parasites,Curing kidney asthenia,tinnitus, and Lumbago-leg pain Curing palpitation, insomnia, mental subnormality,Promoting digestion and dieresis appetite, and curing abdominal distension.	16,17
Cocus nucifera	Coconut,Nariyal, Yubi,Tennai	Coconut shell fiber -Diarrhea treatment ,Amenorrhea ,Venereal diseases treatment , Antipyretic, kidney inflammation,Diuretics, Root -gonorrhea treatment Pulp of coconut -Urogenital inflammation,Amenorrhea, dysmenorrheal Coconut water inflorescence -Asthma treatment , Abscesses, dermatitis treatment and injuries,Burns and stomach pains.	18, 19,20, 21,22, 23, 24, 25,26,27,28,29
Phoenix dactylifera	Nakhleh, Khejur , Date, Phoinix Khajur Pinda, Datter Kharjura, Pinda	Fruit – Sweet, cooling, tonic, fattening, aphrodisiac,alexiteric, useful in leprosy, thirst, asthama, bronchitis,fatigue, tuberculosis, abdominal complaints, fever,vomiting, loss of consciousness and useful in vata disease. Leave - Aphrodisiac and good for the liver. Flower- Bitter, purgative, expectorant, tonic to the	30,31,32

		liver,fever and blood complaints. Seed - Applied to wounds, lesions, inflammation,demulscent, expectorant, laxative, nutrient and prescribed in the case of asthma, gonorrhea. Gum – Useful remedy in diarrhea and disease of the genitor-urinary system7.	
Archontophoenix alexandrae	**King palm,Feather palm**	**leaf sheathes-Neurological disorders,in some cardio vascular diseas,certain type of cancer.**	**33, 34**
Caryota mitis	**Fishtail palm**	**Flower - used to treat gastric ulcer, migraine headaches, snake bite poisoning as well as rheumatic swellings[4].**	**35,36**
Caryota urens	**Mari, Bagane**	**Seed flour- to treat gastric ulcers, migraine headaches, snake-bite poisoning and rheumatic swellings. Root- is used for treating tooth ailments. Bark and seed- are used to treat boils. tender flowers- are used for promoting hair growth. Flower- is used to treat gastric ulcer, migraine headaches, snake bite poisoning as well as rheumatic swellings**	**37,38,39**
Rhapis excels	**Lady palm,Bamboo palm**	**Burned or charred bark applied externally to stop bleeding. Decoction of roots or ashes from burnt bark used for rheumatism; also used to stimulate blood circulation. Used as hemostatic and antidysenteric**	**40,41,42**
Chamaerops humilis	**European fan palm,Mediterranean Fan palm**	**leaf extracts for the treatment of diabetes, digestive disorders, spasm, toning and gastrointestinal disorders diseases ,decreased total cholesterol and triglycerides,**	**43**
Borassus flabellifer	**Toddy palm**	**Fruit pulp helps to cure skin inflammations. It is used to treat nausea and vomiting as well as worm infestation. It is used as an expectorant and also as a liver tonic. A thin layer of palm fruit jelly applied to the affected area has a soothing effect and immediately alleviates the itchiness associated with prickly heat. It is used effectively to treat digestive problems and other stomach ailments. It is also used as a laxative. 'Neera' and toddy are good for controlling gastric troubles and ulcers. Palm sugar Counteracting agent for poison and to treat liver disorder Spadix To treat heartburn and enlarges**	**44,45,46,47**
P. sylvestris	**Scots pine**	**Fruit -Increasing lactation ,Toothache, Gonorrhea ,Asthma, Cough,dehydration, Diarrhea,,Fever, Heart-related,problems, Pains, Toothache,,Tuberculosis Root – Toothache Sap- Diarrhea Stomach ache Seed – Dysentery**	**48,49,50**

Table 2: Phytoconstituents Present in family Arecaceae

S. NO.	Species	Phytoconstituent	Refrences
1	*Washingtonia robusta*	Quercetin ,Epigallocatechin Mangiferin,Gallocatechin gallate,Kaempferol,Gallic acid ,Hydroxybenzoic acid ,Caffeic acid, p-cumaric ,Ferulic acid ,Protocateic acid	52,53
2	*Salacca zalacca*	Quercetin	54
3.	*R. excels*	Luteolin,Vitexin,Vicenin,Isoorientin	40,41

		Orientin,Protocatechuic ,Benzoic acid ,Catachine ,Caffeic ,Syrngic Vanillic ,Ferulicacid ,Sinapic acid ,Cinnamic acid,Coumarin	
4	***Phoenix dactylifera***	**Apigenin,Luteolin,Quercetin,Diosmetin,Kaempferol Procyanidin ,Isoquercetin ,Rutin,Lutein,B-Carotene Neoxanthin,Viola xanthin,Anthcraxanthin,p-hydroxybenzoic acid ,Protocatechuic acid ,Vanillic acid ,Gallic acid ,Syringic acid ,o-coumaric acid ,p-coumaric acid ,Caffeic acid ,Ferulic acid Xanthoxylic acid ,Hydrocaffeic acid,Coumaroylquinic acid, Catechin ,Pelargonin**	**30,31,32**
5	***Areca catechu***	**Isorhamnetin ,Chrysoeriol, Luteolin ,5-hydroxy-2-(4-hydroxy-3,5dimethoxyphenyl)-7-methoxychroman-4-one Quercetin,(s)-5-hydroxy-2-(4-hydroxy-3,5 –dimethoxyphenyl)-7-methoxychroman-4-one Liquiritigenin, Arecoline 2,6-di –t-butyl-4-methylphenol Methyl cinnamate,Nonanoic acid ,`2,4-di-t-butylphenol,Benzoic acid,Lauric acid Myristic acid ,Pentadecanoic acid ,Ursolic acid acetate Sitosterol,Arborinol,Cylindrin Fernenol,Arundoin,Cycloatanol,Ergosterol ,peroxideB-sitostenone, Proline,Tyrosine,Phenylalanine Arginine,Tryptophan Methionine,N-benzoylphenylalanlphenyllalinol acetate,TMS-58B,Aspartic acid Glutamic acid,Lysine,Arginine, Arecatannin A1,Arecatannin A2 Arecatannin A3,Arecatannin B1 Arecatannin B2,Arecatannin C1 Areoline, Arecaine, Guvacoline, Guvacine, Arecolidine, Homoarecoline Isoguvacine, Gallic acid, Coumaric acid, Epicatechu, Ferulic acid, Rutin Naringin**	**16,17,55,59, 60,67**
6.	***Mauritia flexuso***	**Kaempferol, Cathecin, Luteolin, Rutin, Orientin, Lycopene**	**56**
7.	***Euterpe oleracea***	**Cathecin, Luteolin, Rutin, Orientin**	**57**
8.	***Caryota mitis***	**Quercetin, Isoquercetin, Rutin**	**35,36**
9.	***H.verschaffelttii***	**Quercetin,Quercetin-7,3,4-trimethoxy,Luteolin**	**58**
10.	***Serena repens***	**Oleic acid, Lauric acid, Myristic acid, Palmitic acid, Linoleic acid**	**61**
11.	***Caryota urens***	**Hexanoic acid, Dodecanoic acid ,Nitrous acid, Lignoceric acid, 11-octadecenoic acid 9,12-octadecenoic acid, Linolenic acid Benzoic acid, Stearic acid, Oleic acid 10-undecenoic acid,8-nonynoic acid, Hendecynoic acid, Palmitic acid,3-butanoic acid**	**37,38**
12	***Acrocomia aculeata***	**B-carotene,Lutein**	**57**
13.	***Archotophoenix alexander***	**Gallic acid ,3,4-dihydroxybenzoic acid Chlorogenic acid Syringic acid, Caffeic acid**	**33,34**

Table 3 : Biological activity of family Arecaceae

S.N.	Species	Plant parts	Activity studies	Tested extracts	Refrence
1	**Archontophoeni**	**Leaf sheath**	**Antioxidant**	**Aqueous**	**33,34**

	x alexandrae				
2	**Areca catechu**	**Areca nut**	**Antioxidant, Anti-inflammatory, skin-aging and cosmetics, hypoglycemic activity , Antihypertensive, alpha glucosidase inhibitionand, hypoglycemic, hypolipideamic, antimicrobial, Vascular relaxation, Antidepressant platelet aggregation inhibitory activity , antiradical capacity ,anti-allergic , prevention of dental cavities, antiallergic ,central nervous system stimulant ,anti-HIVactivity, molluscicidal activity**	**Ethanolic**	**16,17,55,59,**
3	**Caryota mitis**	**leaves**	**Antimicrobial activity , antibacterial activity**	**Ethanol**	**35,36**
4	**Caryota urens**	**Leaves Immature fruits Fruit skin**	**Antioxidant Antimicrobial Larvicidal activity Anti-inflammatory Antidiabetic, Remediation activity**	**Methanol**	**37,38,39**
5	**Chamaerops humilis**	**Leaves Seeds Pulp and peel**	**Antioxidant Enzyme- inhibition activity**	**Methanol**	**43**
6	**Cocos nucifera**	**Husk Endocarp Husk Fiber Endocarp Husk oil husk**	**Anti-inflammatory activity Anti-bacterial Anti-parasitic Anti-leishmania activity Antioxidant Depressant and Anti-convulsant, Antimalarial Antineoplastic, Antithrombotic effect, Anti-atherosclerotic effect Hypolipid effect Antiprotozoal activity Antidiabetic effect Hepatoprotective Anticholecystitic effect**	**Aqueous Ethanol Ethanol Ethyl acetate Ethanol Aqueous Methanol Methanol Aqueous**	**18,19,20,21,22, 23,24**
7	**Hyophorbe verschaffeltii**	**Leaves**	**Antioxidant**	**Methanol**	**58**
8	**Livistona chinensis**	**Fruit**	**Antioxidant, Antiproliferative**	**Water Chloroform**	**48**
9	**Phoenix pusilla**	**Root**	**Antioxidant, Antimicrobial**	**Ethanol**	**77**
10.	**Phoenix sylvestris**	**Root Leaves Seed Leaves**	**Anthemintic activity Antimicribial Antibacterial Antioxidant**	**Ethanol Methanol Methanol Methanol**	**48,49,50**
11	**Rhapis repens**	**Leaves**	**Antioxidant, Antimicrobial Antibacterial**	**Aqueous**	**40,41,42**
12.	**Serenoa repens**	**Leaves**	**Antiproliferative, Anti-inflammatory**	**Hexane**	**68**
13	**Washingtonia robusta**	**Fruit**	**Antioxidant**	**Methanol**	**52, 53**
14.	**Mauritia flexuosa**	**Pulp oil**	**Antimicrobial and Antibiotic,activity, Antibacterial, Antimicrobial activity Insecticidal activity**	**Hexane**	**56,57**

			Hypocholesteroloenic effect, Antiplatelets Anti-inflammatory		
15	**Euterpe oleraceae mart.**	**Pulp** **Oil** **Concentrate juice Frozen concentrated juice**	**Antimicrobial and antibiofilm activity Histological and histochemical Anti-lipidaemic and anti-inflammatory Anti-lipidaemic Anti-inflammatory**	**Hexane**	**57**
16	**Acrocomia aculeate**	**Pulp oil dehydrated pulp leaves**	**Antioxidant lipid oxidation** **Antimicrobial**	**Hexane**	**57**

CONCLUSIONS

Species of family Arecaceae have been used as a conventional medicine across the globe as it is a rich source of isoflavonoids, rotenoids, sterols, phenolic compounds, coumarin, terpenoids, resin, saponins, etc . The present review reports traditional uses, phytochemical constituents and pharmacological activities based on ethnopharmacological claims of family *"Arecaceae.* Extensive literature survey revealed that most of the species are used traditionally in different African and Asian countries etc where, only a few species were scientifically evaluated for their phytochemical constituents Quercetin, Luteolin, Orientin, Rutin, Arecoline, Benzoic acid, oleic acid, Palmitic acid, Neoxanthin, Lycopene, Sitosterol, Arundoin, Kaempferol etc. that could mediate particular pharmacological activities. The major traditional use of species of family Arecaceae as reviewed involved in the treatment of joint pain, rheumatoid arthritis, hepatitis amenorrhea, tuberculosis, chronic bronchitis, insecticide, skin disease, vermifuge which have been validated scientifically. It is observed that most of the pharmacological activity studies were limited to both *in-vitro* and *in-vivo* screening where, the mechanisms of action, bioavailability and pharmacokinetics are not explored clearly. Furthermore, a number of studies were done for the bioassay-guided extraction and isolation of phytochemical constituents. Further research should target on the exploration and validation of traditional claims of other species by focusing the bioassay-guided drug discovery along with the formulation and mode of administration of drugs which we found lacking in most of the reviewed literature. So, further well designed and more clinical in-depth studies are required by focusing on the mechanism-

based *in vitro* and *in vivo* studies for understanding the underlying mechanisms linked to ethnopharmacological uses.

Conflict of interest: The authors declare no conflict of interest.

Ethical approval: The authors are grateful to Department of Chemistry, Kanya Gurukula campus, Gurukula Kangri (Deemed to be University), Haridwar for providing all the necessary facilities. Supriya Dubey performed the literature search analysed the data, created tables and figures. Abha Shukla approved the manuscript for final submission.

REFRENCES

[1] Dar RA, Shahnawaz M, Qazi PH. General overview of medicinal plants A review. The Journal of Phytopharmacology. 2017; 6(6): 349-351.

[2] Renuka K, Devi VR, Subramanian SP . Phytochemical screening and evaluation of *in vitro* antioxidant potential of immature palmyra palm (*borassus flabellifer* linn.) fruits. *International Journal of Pharmacy and Pharmaceutical Sciences*. 2018; 10(8):0975-1491.

[3] Saravanan C, Priya B, Asir Bradley S, Sundaram U .Preliminary phytochemical screening of antibacterial activity of palmyra palm (*borassus flabellifer)* root extract. *International journal of pharmaceutical science and research.* 2012; 3(11): 4489-4491.

[4] Sahni C, Shakil NA, Jha V, Gupta RK. Screening of Nutritional, Phytochemical, Antioxidant and Antibacterial activity of the roots of *Borassusflabellifer* (Asian Palmyra Palm). *Journal of Pharmacognosy and Phytochemistry*. 2014; 3(4): 58-68.

[5] Alamelumangai M, Dhanalakshmi J, Mathumitha M, Renganayaki RS , Muthukumaran P, Saraswathy N . In vitro studies on phytochemical evaluation and antimicrobial activity of Borassus flabellifer Linn against some human pathogens. *Asian Pacific Journal of Tropical Medicine*. 2014; 7(1): 182-185.

[6] Krishnaveni TRS, Arunachalam R, Chandrakumar M, Parthasarathi G, Nisha R. Potential Review on Palmyra (*Borassus flabellifer* L.). *Advances in Research.* 2020; 21(9): 29-40.

[7] Zandi P, Arecaceae: The Majestic Family of Palms. *Encyclopedia of Earth* .201

[8] Edwino S. Fernando .The Genus Heterospathe (Palmae: Arecoideae) in the Philippines. *Kew Bulletin* .1990.

[9] Bayton RP, Ouédraogo A, Guinko A. The genus *Borassus* (Arecaceae) in West Africa, with a description of a new species from Burkina Faso. *Botanical Journal of the Linnean Society*. 2006; 150: 419–427.

[10] Petoe P, Baker WJ. A monograph of *Heterospathe* (Areceae, Arecaceae) in New Guinea. *Phytotaxa.* 2019; 413(2): 071–1160.

[11] Christenhusz MJM, Byng JW. The number of known plants species in the world and its annual increase. *Phytotaxa*. 2016; 261(3): 201–17.

[12] De Souza FG, de Araujo FF, De Paulo Farias D, Zanotto AW, Neri-Numa IA , Pastore GM. Brazilian fruits of Arecaceae family: An overview of some representatives with promisingfood, therapeutic and industrial applications. *Food Res Int*. 2020: 138.

[13] Jain P, Jain S, Sharma S, Paliwal. Diverse application of Phoenix sylvestris: A potentialherb. *Agric Nat Resour*. 2018; 52(2): 107–14.

[14] Ahmed El-Mokhtar M, Abd El-Baky AM, Abdelhakim IA ,Bishay DW. Chemical constituents and antimicrobial activity of the leaves of Caryota mitis Lour. (Arecaceae). *J MedPlants Stud.* 2017.

[15] Okoduwa SIR, Umar IA, James DB, Inuwa HM, Habila JD. Evaluation of extraction protocols for anti-diabetic phytochemical substances from medicinal plants. *World J. Diabetes.* 2016; 7(20): 605.

[16] Xiao Y, Yang Y, Yong J, Lu C. Chemical Components and Biological Activities of *Areca catechu L.* Biomedical Research and Reviews. 2019:2515-9186.

[17] Shen XL, Duan LL. Advances in chemical constituents and pharmacology of areca. *J Yichun Coll.* 2009; 31: 95-97.

[18] Esquenazi MD, Wigg MM, Miranda, Rodrigues HM, Tostes JBF, Rozental S, Antimicrobial and antiviral activities of polyphenolics from Cocos nucifera Linn. (Palmae) husk fiber extract. Res Microbiol, 2002; 153: 647-652.

[19] Holdsworth D, Wamoi B. Medicinal plants of the Admiralty Islands, Papua New Guinea, Part I. Int J Crude Drug Res. 1982; 20: 169-181.

[20] Holdsworth D. Medicinal plants of the Gazelle peninsula New Britain Island, Papua New Guinea, Part I. Int J Pharmacog. 1992; 30: 185-190.

[21] Yartey J, Harisson EK, Brakohiapa LA, Nkrumah FK. Carbohydrate and electrolyte content of some homeavailable fluids used for oral rehydration in Ghana. J Trop Pediatr. 1993; 39: 234 237.

[22] Caceres A, Giron LM, Alvarado SR, Torres MF. Screening of antimicrobial activity of plants popularly used in Guatemala for the treatment of dermatomucosal diseases. J. Ethnopharmacol. 1987; 20: 223-237.

[23] Weniger B, Rouzier M, Daguilh R, Henrys D,Henrys JH , Anton R. [Traditional medicine in the Central Plateau of Haiti. 2. Ethnopharmacologic inventory], J Ethnopharmacol. 1986; 17: 113-30.

[24] Mitchell SA, Ahmad MH. A review of medicinal plantresearch at the University of the West Indies, Jamaica. West Indian Med J. 2006; 55: 243-269.

[25] Amico A. Medicinal plants of Southern Zambesia. Fitoterapia. 1977; 48: 101-139.

[26] Ramirez VR, Mostacero LJ, Garcia AE, Mejia CF, Pelaez PF, Medina CD. Vegetales empleados em medicina tradicional Norperuana, Trujillo: Banco Agrario del Peru & NACL Univ Trujillo .1988.

[27] Wong W. Some folk medicinal plants from Trinidad. Econ Bot. 1976; 30: 103-142.

[28] Calzada F, Yepez-Mulia L, Tapia-Contreras A. Effect of Mexican medicinal plant used to treat trichomoniasis on *Trichomonas vaginalis* trophozoites. J Ethnopharmacol, 2007; 113:248-251.

[29] Al-Adhroey AH, Nor ZM, Al-Mekhlafi HM, Amran AA & Mahmud R .Evaluation of the use of *Cocos nucifera* as antimalarial remedy in Malaysian folk medicine . J Ethnopharmacol. 2011; 134: 988-991.

[30] Al-Farsi M, Alasalvar C, Morris A, Baron , Shahidi F. Comparison of antioxidant activity, anthocyanins, carotenoids, and phenolics of three native fresh and sun-dried date (*Phoenix dactylifera* L.) varieties grown in Oman . *J. Agric. Food Chem.* 2005; 53: 7592–7599.

[31] Al-Farsi M, Alasalvar C, Morris A, Baron M ,Shahidi F .Compositional and sensory characteristics of three native sun-dried date (*Phoenix dactylifera* L.) varieties grown in Oman . *J. Agric. Food Chem.* 2005; 53: 7586–7591.

[32] Al-Farsi M, Morris A, Baron M. Functional properties of Omani dates (*Phoenix dactylifera* L.). *Acta Hortic.* 2007; 736: 479–487.

[33] Berbari SAG, Prati P , Junqueira VCA . Industrial adaptability of the heart of palm from Archontophoenix alexandrae and A. cunninghamiana. Cieˆncia e Tecnologia de Alimentos, 2008; 28: 135–141.

[34] Ca mara M , Dı ez C. , Torija E. Chemical characterization of pineapple juices and nectars. Principal components analysis. Food Chemistry .1995;54: 93–100.

[35] Abdelhakim IA, El-Mokhtar M A, El-Baky AA, Bishay DW. Chemical constituents and antimicrobial activity of the leaves of *Caryota mitis* Lour. (Arecaceae). Journal of medicinal plants studies. 2017; 5(5): 250-255.

[36] Sharief M .Plants folk medicine of Negrito tribes of Bay Islands. Indian J Tradit Knowl, 2007;6:468-476.

[37] Chauhan G , Gadhvi R .*Caryota Urens*- Underutilized Multipurpose Medicinal Plant . *International Journal of Scientific Research and Reviews*. 2018; 8(1): 1942-1953.

[38] Ranasinghe P, Premakumara GAS, Wijayarathna CD. Antioxidant Activity of *Caryota urens* L. (Kithul) Sap. Trop Agri Res. 2012a; 23(2): 117–125.

[39] Marasini BP, Baral P, Aryal P . Evaluation of Antibacterial Activity of Some Traditionally Used Medicinal Plants against Human Pathogenic Bacteria. BioMed Res. Int.2015.

[40] Hassanein HD, Elsayed WM , Abreu AC , Simões M , Abdelmohsen MM . Polyphenolic constituents and antimicrobial activity of *Rhapis excels* (*Arecaceae, Coryphoideae*). Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2015; 6(1): 1714.

[41] Abreu AC, Borges A, Saavedra MJ, Simões M. Antibacterial activity of phenyl isothiocyanate on

Escherichia coli and *Staphylococcus aureus*. Medicinal Chemistry. 2012; 12: 756-761.

[42] Abreu AC, Serra S, Borges A, Saavedra MJ, Salgado A, Simões ,M. Evaluation of the best method to assess antibiotic potentiation by phytochemicals against *Staphylococcus aureus*, Diagnostic Microbiology and Infectious Diseases. 2014; 79: 125-134.

[43] Gonçalves S, Medronho J, Elsa Moreira, Grosso C, Andrade P B, Valentão P, Bioactive properties of *Chamaerops humilis* L.: antioxidant and enzyme inhibiting activities of extracts from leaves, seeds, pulpand peel . Biotech. 2018; 8: 88.

[44] Krishnamoorthy R, Devi VR , Subramanian SP, Phytochemical screening and evaluation of *in vitro* antioxidant potential of immature palmyra palm (*borassus flabellifer* linn.) fruits. International Journal of Pharmacy and Pharmaceutical Sciences. 2018; 10(8).

[45] Sahni C, Shakil N A, Jha V, Gupta R K. Screening of Nutritional, Phytochemical, Antioxidant and Antibacterial activity of the roots of *Borassus flabellifer* (Asian Palmyra Palm). Journal of Pharmacognosy and Phytochemistry. 2014; 3(4): 58-68.

[46] Paschapur MS, Patil MB, Kumar R, Patil SR. Influence of ethanolic extract of *Borassus flabellifer* L. male flowers (inflorescences) on chemically induced acute inflammation and poly arthritis in rats . International Journal of PharmTech Research. 2009c; 1(3): 551.

[47] Devi S, Arseculeratne SN, Pathmanathan R, McKenzie IF, Pang T. Suppression of cell-mediated immunity following oral feeding of mice with palmyrah (*Borassus flabellifer L*) flour. The Australian Journal of Experimental Biology and Medical Science 1985; 63(4):371.

[48] Jain P, Jain S, Sharma S, Paliwal S, Diverse application of Phoenix sylvestris: A potential herb. Agriculture and Natural Resources. 2018; 52: 107-114.

[49] Alawa KS, Ray S. Ethnomedicinal plants used by tribals of Dhar district, Madhya Pradesh, India. CIBTech J. Pharm. Sci. 2012; 1: 7-15.

[50] Anisuzzaman M, Rahman AHMM, Harun-Or-Rashid M, Naderuzzaman ATM, Islam AKMR, An ethnobotanical study of Madhupur, Tangail. J. Appl. Sci. Res. 2007; 3: 519-530.

[51] Panche AN, Diwan AD, Chandra SR. Flavonoids: an overvi. Journal of nutritional science, 2016; 5(47): 1 – 15.

[52] Armenta-Méndez L, Ortega-Nieblas M M , Gallo-Reynoso J P , Gardea A A , Wilder B , González-Aguilar G , Preciado-Saldaña A M, Proximal chemical analysis and secondary metabolites in *Washingtonia robusta* fruit (Arecaceae).Botanical Sciences. 2019; 97(2): 155-166.

[53] Benahmed-Bouhafsoun A, Djebbar H, Kaid-Harche M .Determination of Polyphenolic Compounds of *Washingtonia robusta* H. Wendl Extracts. *Acta Physica Polonica* A, 2015; 128: 465-466.

[54] Ridho A, Wathoni A, Subarnas A, Levita J, Insights of phytoconstituents and pharmacology activities of Salacca plants. Journal of Applied Pharmaceutical Science. 2019; 9(10): 120-124.

[55] Yang WQ, Wang HC, Wang WJ, Wang Y, Zhang XQ. Chemical constituents from the fruits of Areca catechu. *Zhong Yao Cai.* 2012; 35: 400-403.

[56] Candido T L N, Silva M R. Comparison of the physicochemical profiles of buriti from the Brazilian Cerrado and the Amazon region. *Food Science and Technology.* 2017; 37(1), 78–82.

[57] Gama de Souza F, Araújo FFD, Farias DDP, Zanotto AW, Neri-Numa IA, Pastore GM. Brazilian fruits of Arecaceae family: An overview of some representatives with promising food, therapeutic and industrial applications. Food Research International. 2020; 138: 109-690.

[58] Elgindi MR, Singa AEN, Aly SH, Mahmoud II. Phytochemical investigation and antioxidant activity of *Hyophorbe verschaffeltii* (Arecaceae). Journal of Pharmacognosy and Phytochemistry. 2016; 5(2): 39-46.

[59] Yi P, Tang YR, Zhou F. Advances in chemical consituents and pharmachological activities of betel

nut .*Chin Herbal Med.* 2019;50: 2498-2504.

[60] Zhou WH, Li ZH, Zhang HD. Extraction and fatty acid analysis of areca nut oil. *Chin J Grain Oil* .2010; 25: 38-41.

[61] Marti G, Joulia P, Amiel A, Fabre B , David B , Fabre N , Fiorini-Puybaret C .Comparison of the Phytochemical Composition of Serenoa repens Extracts by a Multiplexed Metabolomic Approach. Molecules. 2019; 24: 2208.

[62] Young AJ & Lowe G L. Carotenoids—Antioxidant Properties. Antioxidants. 2018; 7(28).

[63] Singh R. Medicinal plants: A review .Journal of Plant Sciences. 2015; 3(1): 50-55.

[64] Desai SD, Desaib DG, Kaur H. Saponins and their Biological Activities. Pharma Times, 2009; 41(3).

[65] Cox-Georgian D, Ramadoss N, Dona C, Basu C. Therapeutic and Medicinal Uses of Terpenes. Springer Nature Switzerland AG. 2019.

[66] Akram M, Asif H M , Uzair M, Akhtar N, Madni A, Shah A M, Hasan Z U, Ullah A, Amino acids: A review article. Journal of Medicinal Plants Research. 2011; 5(17): 3997-4000.

[67] Mou X N, Yang WQ, Wang WJ. The chemical composition of betel nut. *J Jinan University.* 2014; 35: 56-60.

[68] Khanbabaee K, Ree TV. Tannins: Classification and Definition. *Nat. Prod. Rep*. 2001; 18: 641–649.