

REVIEW ARTICLE

Medicinal usage of some *Arecaceae* family members with potential anticancer effect

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Received: November 25, 2021; accepted: January 20, 2022.

Many studies have shifted the attention from the synthetic bioactive compounds to the naturally existing ones for the purpose of novel therapeutic agent(s). Such studies focused on the bioactive compounds from natural sources. The bioactive compounds from natural sources, which are developed in living systems, are supposed to be more biological friendly than synthesized ones, making them excellent therapeutic candidates for further discovery of drugs. Cancer is one of the leading deaths causes worldwide associated with uncontrolled proliferating cells. Chemotherapy is one of the first line treatment debulking surgery for many tumors. Hence, investigating the natural resources like plant and animal tissues to find out anti-cancer agents shows long standing interest for many researchers worldwide. In this study, we reviewed literatures for the medicinal uses of some *Arecaceae* family members with focus on their potentials as the anti-proliferating and/or cytotoxic agents, and further, making them a good source for potential anti-cancer agents.

Keywords: *Arecaceae*; medicinal usage; antioxidant; anti-cancer.

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Introduction

One of the leading deaths causes worldwide is cancer which is associated with uncontrolled proliferation of ordinary and/or malignant cells [1]. Old cells are not destroyed and continue to grow in an uncontrolled manner and form new abnormal cells. These strange cells form masses of tissue called tumors [2]. According to the latest statistics, liver and breast cancers are considered to be the highest incidents among males and females, respectively, followed by prostate and bladder carcinomas [3]. This circumstance forced scientists to study its prevention and treatment. Within 20 years, many laboratories have begun working on herbal derived drugs and their anti-cancer effects on human as the polyphenols are

considered as an ingredient in the discovery of cancer medicine [2].

Through the past ten years, more than 60% of the conventional adjuvant chemotherapy were derived from natural source including topoisomerase inhibitors (topotecan and irinotecan), cell division repression (vinblastine) [4], leukocyte production and maturation suppression (vincristine) [5], DNA alkylating (trabectedin), and anti-tubulin agents (eribulin) [6]. Cancer prevention and treatment through arbitration using multiple natural compounds continue to receive substantial interest. Although combining phytochemical compounds with chemotherapy has taken to be a plus in targeting different tumor pathways [7], these drugs should

have no cross-resistance and no overlapping adverse reactions [8]. Also, these drugs have a role by targeting multiple pathways, or targeting the same pathway through different mechanism, which can maximize the response to treatment while limiting toxicity to normal tissues [9].

The palm family (*Arecaceae*) consists of 181 genera and 2,600 species, distributed mainly in tropical and subtropical regions of the world, but dendrite palms can also occur in dry areas of desert climates. The *Arecaceae* species can all be morphologically and functionally different based on the ecosystem in which they grow [10-12]. *Arecaceae* is considered a family of monocotyledonous plants, including many types of tropical mountaineers, shrubs, and trees, commonly known as palm trees. *Arecaceae* is a monotypic family of *Arecales* which includes several commercially important species such as coconut, regional nuts and dates, as well as many indoor and ornamental species. Many plants of this family also have several biological and anti-cancer effects. The palm trees of this family can be distributed especially in tropical and subtropical coastal areas and can grow in the Arabian Desert [13]. This family has a lot of plants that have antioxidant and anti-cancer effects. We summarized them briefly below.

Some *Arecaceae* family members with medicinal impacts

1. *Arum Palaestinum* Boiss

Arum L. is a genus of flowering plant belonging to *Arecaceae* family and is represented by 26 species and distributed in Northern Africa, Mediterranean region, Western Asia, and Europe [14]. It is edible and considered as ornamental plant and used in folk medicine to cure several chronic diseases such as stomach acidity, atherosclerosis, cancer, and diabetes [15, 16]. *Arum* species contain many plants which have many medicinal benefits and anti-cancer effects according to the research of El-Desouky, *et al.* [17]. Few studies showed the phytochemical investigation and biological activity of *A.*

palaestinum. It is characterized by presence of alkaloids, proanthocyanidins, flavones, C-glycosides, and flavonols [14, 17]. A comprehensive metabolite profiling of *A. palaestinum* leaves by using liquid chromatography tandem mass spectrometry was studied by Abu-Reidah, *et al.* [18]. It is worth to mention that in all published reports of its phytochemical studies, leaves and flowers of *A. palaestinum* were used and evidenced for strong anti-tumor activities of its extracts and isolated compounds were provided [14, 19]. Recent studies on the leaves and the flowers of *Arum palaestinum* have shown that four flavonoid compounds were isolated (luteolin, chrysoeriol, isoorientin, isovitexin) from the diethyl ether and ethyl acetate. The extracts and the pure isolated compounds showed a significant high anti-proliferative activity against many investigated cell lines such as "larynx, cervix, liver, and breast" cancer cells [20]. Recent studies on the root of *Arum palaestinum* verified the contents of isovanillin, linolenic acid, and β -sitosterol as major contributors to anti-cancer effects for prostate cancer *in vivo* and *in vitro* [21].

2. *Arum dioscoridis*

Arum dioscoridis SM. var. *dioscoridis* (*A. dioscoridis*) is a member of *Arum L.* genus and belongs to *Arecaceae* family found in many countries like India, Jordan, Palestine, and Turkey. It has been widely used in folk medicine to prevent several chronic diseases such as stomach acidity, atherosclerosis, cancer, and diabetes. Such plant extract showed free radical scavenging activity that can protect the animal body from trace elements. Many parts of the plant have been used in folk medicine, but the leaves of the plant have anti-cancer effect. However, the methanolic extract of the plant showed that it contains many biological compounds which can act as anti-cancer agents according to the results of Yabalak [22].

3. *Arum hygrophilum*

Arum hygrophilum is a traditional medicinal plant indigenous to Jordan. Recent studies explore its phytochemistry, antioxidative, anti-obesity, and

anti-proliferative potentialities. Afifi, *et al.* used column chromatography and high-performance liquid chromatography - mass spectrometry (HPLC-MS) analysis to evaluate its leaf crude water and ethanol extracts' phytochemical activities. The results showed that *Arum hygrophilum* contains three flavonoids (luteolin, isoorientin, and vitexin). In addition, this study showed anticancer effect of *Arum hygrophilum* against colon cancer [23]. The HPLC-MS analysis of the ethanol extract further revealed the presence of caffeic- ferulic, gallic and rosmarinic acids. The ethanol extracts also exhibited 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging and antioxidative capacities [23].

4. *Anthurium schlechtendalii*

Anthurium schlechtendalii belongs to *Arecaceae* family found in Spain and native to Latin America. It is used for many medicinal purposes for the treatment of severe and chronic inflammatory conditions. Cross examination of the plant regarding its anti-neoplastic properties has been done because its molecular targets of anti-inflammatory are common for both pathologic conditions. A polar extract of the Maya healing plant, *Anthurium schlechtendalii* (*Areccea*), leaves and roots exhibited strong anti-cancer activity *in vitro*, and the freeze-dried (not air dried) roots of *A. schlechtendalii* also exhibited strong growth inhibitory and apoptosis-inducing properties for leukemia and breast cancer [24].

5. *Arisaema tortuosum* Schott

Arisaema tortuosum (wall) Schott (*Areccea*) is a plant species that has a distinctive purple or green whip-like spadix, which arises from the mouth of its "jack-in-the-pulpit" flower and may be up to 30 cm long. The plant occurs in rhododendron forest scrub and in pine meadows in the Himalayas, western China, and Southern India. The dried powder and juice of the tubers have been applied to the wounds of cattle in order to kill any parasites and also applied for snake bites [25, 26]. The plant tuber used by Indian tribal people for curing various ailments related to the digestive tract like constipation, indigestion, abdominal pain, and dysentery.

Chemical research showed that *A. tortuosum* contained flavonoids, alkaloids, saponins, triterpenoids, and lectins [27]. Among the protein components, a lectin was proven to be the main pro-inflammatory component, showing anticancer activity against human cancer cell lines [28]. Lectins are glycoproteins of non-immune origin that interact reversibly and specifically with carbohydrates which have various biological activities such as anti-inflammatory, anti-cancer, immunomodulatory, antifungal, antiviral, and anti-insect. Moreover, lectins have been shown to present stimulatory effects in different biological models [29].

6. *Cocos nucifera*

Coconut (*Cocos nucifera*) is an important multipurpose perennial crop of the tropics. Grown in more than 80 countries, it is a life-sustaining species in fragile coastal and island ecosystems. Indonesia, Philippines, India, and Sri Lanka are the major coconut-producing countries. Coconut belongs to the genus *Cocos*, under the subfamily *Arecoideae*. According to Padumadasa, *et al.*, the proanthocyanidins (PAs) were extracted and purified from the immature inflorescence of the coconut leaf in the form of ethyl acetate (ratio of acetone:water was 7:3) using chromatography. PAs belong to a class of polyphenolic compounds called flavonoids that have been reported to have multiple therapeutic effects [30] including anticancer activities through apoptotic inductions, cell cycle interference, and epigenetic modifications. Moreover, PAs can be used in cardiac damage mainly preventing oxidative stress after ischemia, prevention of atherosclerosis, and blood pressure management [31]. *Cocos nucifera* can be considered as a good antioxidant and have anti-cancer activity against cervical and prostate cancer [30].

7. *Elaeis guineensis*

The oil palm tree (*Elaeis guineensis*) from the *Arecaceae* family is a high oil-producing agricultural crop. A significant amount of vegetation liquor is discarded during the palm oil milling process amounting to 90 million tons per

year around the world. This water-soluble extract is rich in phenolic compounds known as Oil Palm Phenolics (OPP). Several phenolic acids including the three isomers of caffeoylshikimic acid (CFA), p-hydroxybenzoic acid (PHBA), protocatechuic acid (PCA), and hydroxytyrosol are among the primary active ingredients in the OPP. Previous investigations have reported several positive pharmacological potentials of OPP such as neuroprotective and atheroprotective effects, anti-tumor, and reduction in A β deposition in Alzheimer's disease model [31]. Vijayarathna and Sasidharan [32] investigated the cytotoxic effect of *Elaeis guineensis* on breast cancer using MCF-7 cell line. *In vitro* cytotoxicity was evaluated by using 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyl-2H-tetrazolium bromide (MTT) assay. The MTT assay results together with the morphological observation indicated that methanol extract of the plant exhibited significant cytotoxic effects on MCF-7 cells on a dose dependent manner.

8. *Colocasia gigantea*

Colocasia gigantea belongs to the *Arecaceae* family, similar to *Colocasia esculenta* (L.) Schott (Taro). *C. gigantea* grows commonly in Thailand and other Southeast Asian countries. In the Pacific islands, the tubers are cooked and eaten as a starch. In India and Bangladesh, the tubers are used as a main ingredient in curries and stews. In Thailand, *C. gigantea* is considered as a minor food crop and is mainly utilized as a stem vegetable. In Thai traditional medicine, *C. gigantea* tuber is heated over a fire. It is used to reduce "internal heat" (fever) and also to treat drowsiness. Fresh tuber has been shown to ameliorate stomach problems, combat infection, and accelerate the healing of wounds. Recent studies on *Colocasia gigantea* concluded that the tuber and leaf extraction using n-hexane as a solvent and HPLC chromatography for separation and extraction contained many anticancer compounds. The results showed that not all parts of *C. gigantea* showed cytotoxic activity. The dichloromethane leaf fraction of the same plant showed significant cell proliferation effect on Hela cells, but not on white blood cells (WBCs). Only the n-hexane tuber fraction exhibited

significant cytotoxicity on Hela cells and encouraged WBC cell proliferation. From GC-Mass spectrometry, 4,22-Stigmastadiene-3-one, Diazoprogestone, 9-Octadecenoic acid (Z)-, hexyl ester, and Oleic Acid were the components that exhibited cytotoxic potential. In addition, *C. gigantea* demonstrated the potential for cervical cancer treatment [33].

9. *Phoenix dactylifera*

Date fruit (*Phoenix dactylifera* L.) is a native fruit of arid region, largely cultivated as an economical and food crop in the Middle East, Southern Europe, North Africa, South America, India, and Pakistan, and belongs to *Arecaceae* family. They contain various phytochemicals like sterols, polyphenols, flavonoids, and glycosides. Ajwa dates have hypolipidemic, antioxidant, anti-inflammatory, cardioprotective, nephron-protective, and hepatoprotective effects. In addition, the concentrated polyphenols and *ex vivo* digested extracts from Ajwa dates inhibited growth and proliferation of colon cancer Caco-2 cell line. Recently, researchers identified that methanolic extract of Ajwa dates inhibited human breast carcinoma cells (MCF-7) by causing cell cycle inhibition and induction of apoptosis [34].

10. *Theriophonum minutum*

Theriophonum is a genus of flowering plants in the family of *Arecaceae*. It is found only in India and Sri Lanka. *Theriophonum minutum* is a wild edible plant shows natural variability and contains relatively higher nutritive values comparing to conventional foods resources. Extensive literature survey reveals that *Theriophonum minutum* has not explored in terms of its phytochemical profile as well as its pharmacological activity. However, it has been reported for its excellent nutritive values. The dried plant was pulverized into powered crude and then extracted using ethyl acetate, ethanol, hydro-alcoholic, and water. *Theriophonum minutum* extracts were subjected to thin layer chromatography to determine the number and nature of phytoconstituents in each extract. The results showed that various extracts of *T.*

minutum demonstrated the presence of sterols, flavonoids, alkaloids, and glycoside. Despite of significant anti-mitotic and anti-proliferative activity, ethanolic *Theriophonum minutum* extract exhibited low cytotoxicity in sulforhodamine. The phytoconstituents are described to have anti-cancer activity [35].

11. *Hyphaene thebaica*

Hyphaene thebaica is commonly referred to as doum, and it is a type of palm tree with edible oval fruit which belongs to the mint family (*Arecaceae*). It grows in the west from Mauritania and Senegal, and east to Egypt, Kenya, and Tanzania. It tends to grow along the Nile River in Egypt and Sudan in the areas which contain groundwater. It is also native to the Levant and the Arabian Peninsula (Israel, Sinai, Yemen, and Saudi Arabia). It grows in valleys and at oases, but it is considered as drought-tolerant and sometimes grows on rocky hillsides. Doum is one of commonly consumed beverages in traditional places in Egypt and is rich in polyphenolic compounds [36]. Abou-Elalla studied the antioxidant capacity of doum fruit extract and also the total phenolic content. The antioxidant capacity was estimated by 1,1-diphenyl-2-picrylhydrazyl (DPPH) and iron chelating assays. The results of the study showed that the doum extract could be an important dietary source of phenolic compounds with high antioxidant and anti-cancer activities [37]. The methanol extract of *H. thebaica* bark showed high cytotoxicity against human cancer cells and free radical scavenging activities but showed no cytotoxic effect on human normal immortalized fibroblast cells (BJ-1) [38]. *H. thebaica* extract showed cytotoxicity against A549 (lung carcinoma) and MCF-7 (breast adenocarcinoma) as 87% and 89%, respectively. Another report demonstrated that the fruit extract of *H. thebaica* had antioxidant and anti-cancer activities against acute myeloid leukemia [39]. It is found that the incubation of tumor cells with doum extract significantly reduced the viability of these cells and the dead cells were significantly increased with high extract concentration.

12. *Borassus flabellifer*

Borassus flabellifer L. belongs to *Palmae* family (*Arecaceae*). It contains several Phytochemicals and carbohydrate like sucrose, albuminoids, fats, gums, and steroidal glycosides. In traditional system of medicine, the *Borassus flabellifer* was used to treat several disease conditions. Plant is reported to possess medicinal properties like diuretic, antioxidant, anti-inflammatory activity, anti-helminthics, immunomodulatory, and wound healing. The methanol extract of leaves of *Borassus flabellifer* was tested and resulted in the presence of major phytochemicals. Extract showed positive results for several phytochemicals like flavonoids, glycosides, tannins, proteins, steroids, triterpenoids, carbohydrates, fats, and fixed oils. Human colon cancer cell line (HCT15), human lung cancer cell line (Hop65), and human hepatoma cell line (HEPG2) were employed to test anti-cancer efficacy of methanol extract of leaves of *Borassus flabellifer* at four different concentrations (10, 20, 40, and 80 µg/mL). The results showed dose-dependent growth inhibitor effects to those cancer cells [40].

13. *Dyopsis lutescens*

Dyopsis lutescens, also known as *Chrysalidocarpus lutescens*, *Chrysalidocarpus glaucescens*, golden cane palm, areca palm, yellow palm, or butterfly palm, is a species of flowering plant in the *Arecaceae* family, native to Madagascar and South India, and naturalized in the Andaman Islands, Réunion, El Salvador, Cuba, the Canary Islands, southern Florida, Haiti, the Dominican Republic. The *D. lutescens* is widely used as an ornamental plant, which possesses strong antioxidant and anti-cancer activities. *D. lutescens* (Golden cane palm)-related studies revealed the presence of flavonoids, tannins, lignans, triterpenes, and steroids. The biological and phytochemical studies on genus *Dyopsis* are limited [41]. The constituent isovitexin which has the source from Areca Palm (*Dyopsis lutescens*) possesses anti-cancer activity. The ornamental palm fruit pericarp of *A. catechu* and *Dyopsis lutescens* have also been reported to possess

strong antioxidant activity using DPPH and reducing power assays [42].

14. *Colocasia esculenta*

Colocasia esculenta is a tropical plant grown primarily for its edible corms, and a root vegetable most known as taro. It is the most widely cultivated species of several plants in the family of *Arecaceae*, which are used as vegetables for their corms, leaves, and petioles. Taro corms are a food staple in African, Oceanic and South Asian cultures (similar to yams), and taro is believed to be one of the earliest cultivated plants. Hawaiians tend to have lower incidence rates of colorectal cancer and it was hypothesized that this might be due to ethnic differences in diet, specifically, their consumption of poi, a starchy paste made from the taro (*Colocasia esculenta* L.) plant corm. Soluble extracts of poi were incubated at 100 mg/mL *in vitro* and showed anti-proliferative activity against the rat YTC colon cancer cell line. Although numerous factors can contribute to the risk of colon cancer, perhaps that poi consumption might contribute to the lower colon cancer rates among Hawaiians by two distinct mechanisms. First, by inducing apoptosis within colon cancer cells, and then Second, by non-specifically activating lymphocytes, that can also lyse cancer cells [43].

15. *Sabal palmetto*

Sabal palmetto (Bartr.) is a small palm tree of the family *Arecaceae*. *S. palmetto* is also known as cabbage palm, palmetto palm, and Sabal palm. *S. palmetto* is a low-growing, shrubby palm widely distributed in Egypt as an ornamental palm. Among all species of *Sabal*, it has been used as a drug for treatment and prevention of prostate hyperplasia and nonbacterial prostatitis. It has also been reported for its anti-inflammatory activity, anti-androgen properties, anti-edema effects, and spasmolytic and smooth muscle relaxant activity [44]. Crude extract of berries was fractionated into two fractions: ethyl acetate and butanol. Ethyl acetate fraction showed good free radical scavenging activity. The ethyl acetate fraction of *S. palmetto* significantly reduced the

viable Ehrlich cell count and increased non-viable count with amelioration of all hematological parameters. Moreover, some studies showed that the plant has anti-tumor and antioxidant prosperities [45].

16. *Areca catechu*

The areca (betel) nut is the seed of the areca palm (*Areca catechu*), which grows in much of the tropical Pacific, Asia, and parts of East Africa. It is commonly referred to as betel nut, as it is often chewed wrapped in betel leaves. Indians and Malaysians chew this seed to refresh breath and smooth digestion. The activities of areca nut include antioxidant, anti-helminthic, anti-diabetic, anti-bacterial, anti-fungal, anti-malarial, and anti-inflammatory. Recent studies on areca nut seed methanolic extracts showed that it has anti-cancer effect against oral squamous cancer cell lines (HSC-2) and breast cancer. The results of flow cytometry analysis on HSC-2 cells showed that areca nut extract could induce late apoptosis activity after 24 and 48 hours of exposure, but the increase of late apoptotic cells occurred more in the following 48 hours exposure. This result was in accordance with a previous study, in which apoptosis was detected by using orange acridine-ethidium bromide staining (double staining). These results demonstrated that treatment with ethanolic extract of areca nut at IC₅₀ of 77 µg/mL for 48 hours inhibited the growth of MCF-7 cells as much as 13–84% [46].

17. *Phoenix sylvestris*

Phoenix sylvestris from *Arecaceae* family is known as "Indian Date Palm", which has been identified as a component of traditional medicine against various ailments. It is widely distributed in South Asia, from Pakistan to Myanmar, across India, Nepal, Bhutan, and Bangladesh. This palm produces edible fruits, but it is generally called "wild date palm" to distinguish it from the closely related *P. dactylifera* which is known as "date palm" and is cultivated agriculturally as the commercial source of dates. There are few studies on its antioxidant and pharmacological properties which showed high phenolic content and antioxidative activities. Recent studies

focused on the phytochemical screening of the crude hexane and methanol of leaf part of the plant. The crude extracts showed the presence of alkaloids, flavonoids, and phenols in the plant leaves. Gas chromatography-mass spectrometry (GC-MS) analysis found the presence of many biologically active compounds such as alcohols, flavonoids, aromatic compounds, aldehydes, terpenoids fatty acid methyl esters, and phenolics. Pentadecanoic acid occupied maximum (52 %) area in GC-MS profiling. The methanolic purified fractions was assayed for *in vitro* cytotoxicity by MTT assay which confirmed its less cytotoxicity at lower concentration and also significant Reactive Oxygen Species (ROS) determination against J774 (mouse macrophage cell line) and THP1 (Human macrophage cell lines) after two and four hours. Also, it has anticancer effect against hepatocellular carcinoma [47, 48].

18. *Medemia argun*

Medemia argun is a mysterious and little-known species of fan palm from the Nubian Desert Oases of Southern Egypt and Northern Sudan. *M. argun* fruits have been found in the tombs from the 5th Dynasty (ca. 2,500 BC) to Roman times (6-7th century AD) including the celebrated tomb of Tutankhamun [49]. It was believed that the fleshy mesocarp and juice of the mysterious and occult *Medemia argun* were good for hypertension [50]. The proanthocyanidin fraction of *M. argun* nuts has been shown to have antioxidative activity against significant biological oxidant and nitrate agent action on blood platelet or plasma proteins, as well as glutathione levels in blood platelets and plasma. Because the role of plasma proteins and platelets in thrombus formation is vital for the abnormal activation of the coagulation cascade, new anti-platelet medicines including antioxidative characteristics of new bioactive substances are critical for the treatment of cardiovascular disorders [51]. A recent study revealed that *M. argun* seeds had chemopreventive effects against hepatocarcinogenesis and were indicated for patients with human colon cancer risk factors, as well as an adjuvant therapy to cancer chemotherapy [52].

Conclusion

Arecaceae is considered a family of monocotyledonous plants including many types of tropical mountaineers, shrubs, and trees commonly known as palm trees. *Arecaceae* is a monotypic family of *Arecales* that includes several commercially important species such as coconut, regional nuts, and dates, as well as many indoor and ornamental species. Many plants of this family also have several biological and anti-cancer effects. Most of those plants have antioxidant and anticancer effects against several type of malignances such as breast cancer, colon cancer, hepatic carcinoma, and leukemia. Moreover, the extraction and purification of those plants yield very important molecules that may help as a source of natural drug or as chemopreventive drugs. This article comprehensively highlighting different species of *Arecaceae* family and their cytotoxic effects against different diseases. It is emphasized that these plants play an important role in the fight against cancer through various classes of secondary metabolites. However, the study of these plants does not limit the study of a wide variety of anti-cancer plants, some of which are still unexplored. Further studies are needed to demonstrate the mechanism of anti-cancer effects of many previously explored and many unexplored plants.

References

1. Omara T, Kiproo AK, Ramkat RC, Cherutoi J, Kagoya S, Moraa Nyangena D, *et al.* 2020. Medicinal plants used in traditional management of cancer in Uganda: a review of ethnobotanical surveys, phytochemistry, and anticancer studies. *Evid Based Complement Alternat Med.* 2020:3529081.
2. Hazafa A, Rehman KU, Jahan N, Jabeen Z. 2020. The role of polyphenol (flavonoids) compounds in the treatment of cancer cells. *Nutr Cancer.* 72 (3):386-397.
3. WHO/IARC. 2020. Egypt Source: Globocan 2020 Number, 895, 1–2. <https://gco.iarc.fr/today/data/factsheets/populations/818-egypt-fact-sheets.pdf>.
4. Newman DJ, Cragg GM. 2016. Natural products as sources of new drugs from 1981 to 2014. *J Nat Prod.* 79(3):629-661.
5. Salerni BL, Bates DJ, Albershardt TC, Lowrey CH, Eastman A. 2010. Vinblastine induces acute, cell cycle phase-independent

- apoptosis in some leukemias and lymphomas and can induce acute apoptosis in others when Mcl-1 is suppressed. *Mol cancer ther.* 9(4):791-802.
6. Jimenez PC, Wilke DV, Branco PC, Bauermeister A, Rezende-Teixeira P, Gaudêncio SP, *et al.* 2020. Enriching cancer pharmacology with drugs of marine origin. *Br J Pharmacol.* 177(1):3-27.
 7. Sauter ER. 2020. Cancer prevention and treatment using combination therapy with natural compounds. *Expert Rev Clin Pharmacol.* 13(3):265-285.
 8. Nikanjam M, Liu S, Yang J, Kurzrock R. 2017. Dosing three-drug combinations that include targeted anti-cancer agents: analysis of 37,763 patients. *Oncologist.* 22(5):576-584.
 9. Gravit L. 2011. Chemoprevention: First line of defense. *Nature.* 471(7339):S5-57.
 10. Balslev H, Bernal R, Fay MF. 2016. Palms—emblems of tropical forests. *Bot J Linn Soc.* 182(2):195-200.
 11. de Souza FG, de Araujo FF, de Paulo Farias D, Zanotto AW, Neri-Numa IA, Pastore GM. 2020. Brazilian fruits of Arecaceae family: An overview of some representatives with promising food, therapeutic and industrial applications. *Food Res Int.* 138:109690.
 12. Emilio T, Lamarque LJ, Torres-Ruiz JM, King A, Charrier G, Burlett R, *et al.* 2019. Embolism resistance in petioles and leaflets of palms. *Ann Bot.* 124(7):1173-1183.
 13. Basu S, Sengupta R, Zandi P. 2014. Arecaceae: The majestic family of palms. *Encyclopedia of Earth.* http://editors.eol.org/eoearth/wiki/Arecaceae:_The_Majestic_Family_of_Palms.
 14. El-Desouky SK, Ryu SY, Kim YK. 2007. Piperazirum, a novel bioactive alkaloid from *Arum palaestinum* Boiss. *Tetrahedron Lett.* 48(23):4015-4017.
 15. Al-Lozi S, Makhadmeh I, Duwayri M, Shibli R, Migdadi H. 2008. Assessment of phenotypic variation of *Arum* species in Jordan. *Jordan J Agric Sci.* (4):367-379.
 16. Makhadmeh I, Al-Lozi S, Duwayri M, Shibli RA, Migdadi H. 2010. Assessment of genetic variation in wild *Arum* species from Jordan using Amplified Fragment Length Polymorphism (AFLP) markers. *Jordan J Agric Sci.* (2):224-239.
 17. El-Desouky SK, Hawas UW, Kim YK. 2014. Two new diketopiperazines from *Arum palaestinum*. *Chem Nat Compd.* 50(6):1075-1078.
 18. Abu-Reidah IM, Ali-Shtayah MS, Jamous RM, Arrázex-Román D, Segura-Carretero A. 2015. Comprehensive metabolite profiling of *Arum palaestinum* (Araceae) leaves by using liquid chromatography–tandem mass spectrometry. *Food Res Int.* 70:74-86.
 19. Aboul-Enein AM, El-Ela FA, Shalaby EA, El-Shemy HA. 2012. Traditional medicinal plants research in Egypt: Studies of antioxidant and anticancer activities. *J Med Plant Res.* 6(5):689-703.
 20. Farid MM, Hussein SR, Ibrahim LF, El-Desouky MA, Elsayed AM, Saker MM. 2014. Shoot regeneration, biochemical, molecular and phytochemical investigation of *Arum palaestinum* Boiss. *Afr J Biotechnol.* 13(34):3522-3530.
 21. Cole C, Burgoyne T, Lee A, Stehno-Bittel L, Zaid G. 2015. *Arum Palaestinum* with isovanillin, linolenic acid and β -sitosterol inhibits prostate cancer spheroids and reduces the growth rate of prostate tumors in mice. *BMC Complement Altern Med.* 15(1):1-8.
 22. Yabalak E. 2018. Radical scavenging activity and chemical composition of methanolic extract from *Arum dioscoridis* Sm. var. *dioscoridis* and determination of its mineral and trace elements. *J Turkish chem soc sect chem.* (1):205-218.
 23. Afifi FU, Kasabri V, Litescu S, Abaza IF, Tawaha K. 2017. Phytochemical and biological evaluations of *Arum hygrophilum* Boiss. (Araceae). *Pharmacogn Mag.* 13(50):275.
 24. Stark N, Gridling M, Madlener S, Bauer S, Lackner A, Popescu R, *et al.* 2009. A polar extract of the Maya healing plant *Anthurium schlechtendalii* (Aracea) exhibits strong *in vitro* anticancer activity. *Int J Mol Med.* 24(4):513-521.
 25. Choudhary K, Singh M, Pillai U. 2008. Ethnobotanical survey of Rajasthan-An update. *Am Eurasian J Bot.* 1(2):38-45.
 26. Sharma PP, Mujumdar AM. 2003. Traditional knowledge on plants from Toranmal Plateau of Maharashtra. *Indian J Tradit Know.* 2(3):292-296.
 27. Kamble SY, Patil SR, Sawant PS, Sawant S, Pawar SG, Singh EA. 2010. Studies on plants used in traditional medicine by Bhilla tribe of Maharashtra. *Indian J Tradit Know.* 9(3):591-598.
 28. Dhuna V, Bains JS, Kamboj SS, Singh J, Saxena AK. 2005. Purification and characterization of a lectin from *Arisaema tortuosum* Schott having *in-vitro* anticancer activity against human cancer cell lines. *BMB Rep.* 38(5):526-532.
 29. Swarnkar S, Katewa SS. 2008. Ethnobotanical observation on tuberous plants from tribal area of Rajasthan (India). *Ethnobot leafl.* 2008(1):87.
 30. Padumadasa C, Dharmadana D, Abeysekera A, Thammitiyagodage M. 2016. *In vitro* antioxidant, anti-inflammatory and anticancer activities of ethyl acetate soluble proanthocyanidins of the inflorescence of *Cocos nucifera* L. *BMC Complement Altern Med.* 16(1):1-6.
 31. Syarifah-Noratiqah SB, Zulfarina MS, Ahmad SU, Fairus S, Naina-Mohamed I. 2019. The pharmacological potential of Oil Palm Phenolics (OPP) individual components. *Int J Med Sci.* 16(5):711.
 32. Vijayarathna S, Sasidharan S. 2012. Cytotoxicity of methanol extracts of *Elaeis guineensis* on MCF-7 and Vero cell lines. *Asian Pac J Trop Biomed.* 2(10):826-829.
 33. MEng AP. 2015. *Amornpun Sereemaspun* M. anticancer activity of selected *Colocasia gigantia* fractions. *J Med Assoc Thail.* 98(1):S98-106.
 34. Khan F, Ahmed F, Pushparaj PN, Abuzenadah A, Kumosani T, Barbour E, *et al.* 2016. Ajwa date (*Phoenix dactylifera* L.) extract inhibits human breast adenocarcinoma (MCF7) cells *in vitro* by inducing apoptosis and cell cycle arrest. *PLoS one.* 11(7):e0158963.
 35. Khulbalkar A, Warokar A, Lohiya R, Umekar M. 2018. phytochemical studies on *theriophonum minutum* extracts and evaluation of its anticancer activity. *JACS.* 4(2):185-187.
 36. Hsu B, Coupur IM, Ng K. 2006. Antioxidant activity of hot water extract from the fruit of the Doum palm, *Hyphaene thebaica*. *Food chem.* 98(2):317-328.

37. Mohamed AN. 2009. Antioxidant and anticancer activities of doum fruit extract (*Hyphaene thebaica*). Afr J Pure Appl Chem. 3(10):197-201.
38. Fayad W, El-Hallouty SM, Meky NH, EL-Menshawi BS, Wassel GM, Hasabo AA. 2015. Evaluation of anticancer activity of some Egyptian plants showed free radical scavenging activity. Int J Pharmtech Res. 8:387-393.
39. Soare JR, Dinis TC, Cunha AP, Almeida L. 1997. Antioxidant activities of some extracts of *Thymus zygis*. Free Radic Res. 26(5):469-478.
40. Gingine AP, Kalyankar TM, Mandge SV, Jamkhande PG. 2016. *In vitro* evaluation of methanolic extract of *borassus flabellifer linn*. Leaves on different human cancer cell lines. AJPTI. 4(20):11-15.
41. Mohamed YF. 2018. Influence of different growing media and kristalon chemical fertilizer on growth and chemical composition of Areca palm (*Dypsis cabadae* HE Moore) plant. Middle East J Appl Sci. 8(1):43-56.
42. Chiduruppa M, Ahmad F, Pandian P. 2018. A detailed review on *Dypsis lutescens* (Arecaceae). World J Pharm Pharm Sci. 7:1644-1650.
43. Brown AC, Reitzenstein JE, Liu J, Jadus MR. 2005. The anti-cancer effects of poi (*Colocasia esculenta*) on colonic adenocarcinoma cells *in vitro*. Phytother Res. 19(9):767-771.
44. Olennikov DN, Zilfikarov IN, Khodakova SE. 2013. Phenolic compounds from *Serenoa repen* fruit. Chem Nat Compd. 49(3):526-529.
45. Ibrahim AY, El-Newary SA, El-Raey MA. 2017. Evaluation of the antioxidant, anti-inflammatory, and antitumor properties of Sabal grown in Egypt. Egypt Pharm J. 16(3):168.
46. Meiyanto E, Susidarti RA, Handayani S, Rahmi F. 2008. The ethanolic extract of areca nut seeds (*Areca catechu* L.) was able to inhibit proliferation and stimulate apoptosis of MCF-7 cells. Indones Pharm Magz. 19(1):12-19.
47. Sharma DC, Shukla R, Ali J, Sharma S, Bajpai P, Pathak N. 2016. Phytochemical evaluation, antioxidant assay, antibacterial activity and determination of cell viability (J774 and THP1 alpha cell lines) of *P. sylvestris* leaf crude and methanol purified fractions. EXCLI J. 15:85-94.
48. Lamia FS, Mukti RF. 2021. Bangladeshi Wild Date Palm Fruits (*Phoenix sylvestris*): Promising Source of Anti-cancer Agents for Hepatocellular Carcinoma Treatment. Int J Appl Sci Biotechnol. 9(1):32-37.
49. Ibrahim H, Baker WJ. 2009. *Medemia argun*--Past, Present and Future. Palms. 53(1):9.
50. Batanouny KH. 1999. Wild medicinal plants in Egypt (An inventory to support conservation and sustainable use), Printed by Palm Press, Cairo, Egypt, pp.207.
51. Morel A, Hamed AI, Oleszek W, Stochmal A, Głowacki R, Olas B. 2014. Protective action of proanthocyanidin fraction from *Medemia argun* nuts against oxidative/nitrative damages of blood platelet and plasma components. Platelets. 25(1):75-80.
52. Abdel-Hamid NM, Abd Allah SG, Hassan MK, Ahmed AA, Anber NH, Adel Faried I. 2021. Possible Protective Potency of Argun Nut (*Medemia argun*--An Ancient Egyptian Palm) against Hepatocellular Carcinoma in Rats. Nutr Cancer. 3:1-2.