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PHARMACOLOGICAL AND ANTIMICROBIAL PROPERTIES OF *CONOCARPUS ERECTUS:* A REVIEW

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Abstract

Conocarpus erectus is a low-evergreen shrub or tree with a typical height of up to 40 feet. Contains phenols such as flavonoids and tannins as main ingredients. *C. erectus* extract from different parts (leaves, stems, fruits and flowers) has shown anti-oxidant, anti-hepatic and anti-cancer activity due to the presence of phenolic compounds. Tannin contains high antimicrobial activity from other phenolic compounds. This review is an attempt to review pharmacological properties, traditional uses, plant chemistry and plant biological activities.

Key words: *Conocarpus erectus*, Pharmacological activity, Antimicrobial , Phytochemical materials.

Introduction

Although, the use of plants to treat various maladies including common infectious diseases is an art as old as mankind, plant-based, traditional medicine continues to play an essential role in health care. About 80% of the world's inhabitants are relying mainly on traditional medicines for their primary health care (Owolabi ,2007) Medicinal plants represent a rich source of antimicrobial agents and a source of many potent and powerful drugs (Mahesh, 2008). In spite of the recent domination of the synthetic chemistry as a method to discover and produce drugs, the potential of bioactive plants or their extracts to provide new and novel products for disease treatment and prevention is still enormous (Bibitha, 2002). Therefore, in recent years, there appears to be a revival in the use of traditional medicinal plants and pharmaceutical companies have spent a lot of money in developing natural products extracted from plants, to produce more safe and cost effective remedies (Maghrani *et al*., 2005). More than 130 drugs, extracted from higher plants, or modified further synthetically, are currently in use, though some of them are now made synthetically for economic reasons. (Newman *et al*., 2008) Although, hundreds of plant species have been tested for their medicinal properties, the vast majority of plants have not been adequately evaluated (Nahla *et al*., 2010). *Conocarpus erectus* L., family Combretaceae, which is commonly called button wood or button mangrove, is a tropical and subtropical evergreen tree. It is widely cultivated as an ornamental tree in many countries around the world, including Saudi Arabia. The tree is 6m tall with spreading crown, grey or brown bark, glaucous medium-green leaves and greenish flowers in dense cone-like heads in terminal panicles (Thakore *et al*., 2011).

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Taxonomy

The brief taxonomical data of the plant is described below:

Class: Equisetopsida C. Agardh

Subclass: Magnoliidae Novák ex Takht.

Order: Myrtales Juss. ex Bercht. & J. Presl

Family: Combretaceae R. Br.

Genus: Conocarpus L.

Description

The species is usually a shrub from 1.5 to 4 m high but can become a tree up to 20 m or more in height. The root system consists mainly of sideways, fine dark brown, weak and brittle roots, and has cork bark. The plant is usually an erect stem or multiple stems, but the shape of prostration and the ends of that layer may assume they become new individuals. The bark is boney gray, curly, fibrous, and moderately thin (approximately 8 mm). The inner bark is a dark cream the color. Stem wood (Specific

Gravity 1.0) is tough, heavy and powerful. The branches are fragile. The branches are slender, yellow-green, angled, flat or winged. They are arranged spirally, oval-shaped, the leaves are somewhat cartilaginous, from 2 to 10 cm wide, with petioles 3 to 9 mm thick. Inflorescences are peripheral particles or small greenish axillary flowers assembled in a globule. It heads up to a diameter of 3 to 5 mm. Thin and dry, 5- to 15 mm flank seeds are filled with the density of the Globus groups (Stevens *et al*., 2001).

Phytochemical studies: In the HPLC analysis of ethyl acetate and n-butanol extracts of leaves, stem, flowers and fruits of *C. erectus* revealed the presence of gallic acid, catechin, apigenin, quercetin, quercetin-3-O-glucoside, kaemferol-3-O-glucoside, rutin and quercetin-3-O-glucoside-6-O-gallic acid (Hameed *et al.,* 2012) Methanol extracts of fruits and stems were found to have high phenolic contents equivalent that is 581.1±9.01and 433.9±6.88 mg/g GAE respectively whereas flowers and leaves have moderate phenolic contents (236.78±14.35 and 216.09±14.35 mg/g GAE respectively). Total flavonoids contents in the methanol extract of leaves was found to be 27.0±1.34 mg/g RE followed by methanol extracts of fruits 19.3±0.66, flowers 11.6±0.33 and stems 6.5±0.83 mg/g RE.(Hameed *et al*., 2014 Safwat 2018) reported that our investigation led to the identification of 12 constituents, representing 97.53% of the total oil such as sesque terpenes, steroid derivative, alkaloid and dialdehyde.The wood of *Conocarpus erectus* contains conocarpol and 22 -methoxyconocarpol, simple 1, 4-diarylbutane-type lignans and conocarpan, a lignan of the dehydrodi-isoeugenol type (Hayashi and Thomson, 1975). The defatted methanol extract of fruits of C. erectus was subjected to chromatographic fractionation on silica gel glass column followed by reversed-phase high-performance liquid chromatography-ultraviolet-electrospray ionisation spectrometry analysis (RP-HPLC-UV-ESI-MS). Ellagic acid, vescalagin/ castalagin isomer and di-(hexahydroxy diphenoyl) galloyl hexose isomer were tentatively identified as major components with many hydrolysable types of tannins on the basis of a comparison of its mass patterns with relevant items in the literature (Hameed *et al*., 2014).

Pharmacological activities:

Antioxidant activity:

Oxidative stress and free radicals have been involved in pathology of many diseases and conditions including diabetes, cardiovascular disease, inflammatory conditions, cancer and aging (Maryam Bashir, 2015). Studies reveal that medicinal plants with antioxidant properties can act as free radical scrapers, reducing agents, chelating agents for transitional minerals, quench single oxygen molecules and antioxidant enzyme stimuli to suppress free radical damage in biological systems. (Okpuzor *et al.,* 2009). Dehydrated methanol extracts of different parts and consecutive parts of C. erectus were examined for their antioxidant properties using phosphomolybdenum and reduced energy methods. Anti-oxidant capacity of methanol extracts of fruits by using phosphomolybdenum method showed higher antioxidant capacity (Mohammed *et al* 2019).

Fig. 1: *Conocarpus erectus*: flowering stage, flowers and fruits.

Hepatoprotective activity:

Liver is a vital organ play a major role in metabolism and excretion of xenobiotic from the body (Kumar *et al*., 2012). Treatment of intoxicated mice with defatted methanol extracts of fruits, flowers, stems and leaves of *Conocarpus erectus* in a dose of 500 mg/kg for two weeks decreased significantly ($p<0.5$ and $P<0.01$) the levels of ALT but there is no significant decrease in blood urea level. No change in total proteins, albumins ,globulins and A/G ratio were recorded when compared to control group. All the four defatted methanol extracts of C. erectus also showed high free radical scavenging activity toward DPPH radical with SC50 between 6.47-9.4ug/ml (Hameed *et al.,* 2013).

Anticancer activity:

Cancer is the abnormal growth of cells in our bodies that can lead to death. Cancer cells usually invade and destroy normal cells (Thakore *et al.,* 2011). Cytotoxicity of the ethyl acetate and n-butanol fractions of the different parts of C. erectus in HepG2 and MCF-7 cell lines by using the sulforhodamine B (SRB). According to the American Cancer Institute (NCI), most of the fractions showed IC50 fall within the NCI criteria, thus these fractions are considered to have a promising anticancer potential (Boik, 2001).

Antimicrobial activity: *Conocarpus* has biological activity against various pathogenic species both fungi and bacteria .Moreover, *Conocarpus* extract contains antibacterial activity in the laboratory .However, the vital activity of species it comes from a bioactive that shows

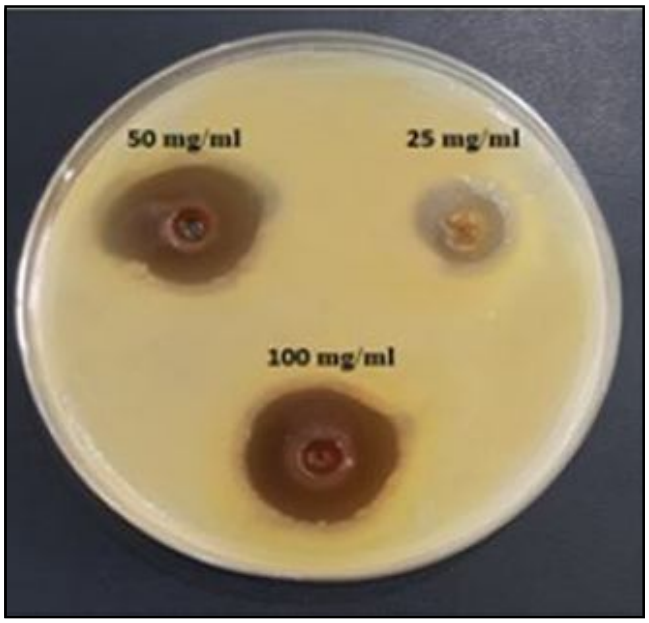

Fig. 2: Antibacterial activity of *Conocarpus erectus* leaves extracts on *Staphylococcus aureus*.

nine alkali compounds, five saponins and eight of the total phenolic compounds (Al-Musayeib, *et al.,* 2012; Hussein, 2016). Maryam Bashir (2015) reported that extracts of C. erectus and purified tannins were evaluated qualitatively and quantitatively for their antimicrobial activities. Alcoholic extracts of leaf, stem, fruit and flower were evaluated against Gram-positive, Gram-negative, acid-fast bacteria and fungi by agar disc diffusion method. Tannins were active against the three tested fungi (*Saccharomyces cerevisiae, Aspergillus niger and Penicillium. notatum*).

Crude extracts from various parts of the plants as well as purified tannins. Tannins were active against three fungal species: *Saccharomyces cerevisiae, A. niger and Penicillium chrysogenum* with inhibition zones of 14.3, 12.5 and 13.3 mm, respectively .Alcoholic extracts of the flowers, fruit, leaf and stem of the plant demonstrated activity only against *S. cerevisiae* with inhibition zones of 11.3, 13.3, 10.3 and 11.0 mm, respectively. When tested against bacteria, flowers and fruits of *C. erectus* were more active than other parts of the plant. Generally, Gram-positive bacteria including *S. aureus and B. subtilis* demonstrated higher sensitivity than Gram-negative bacteria. Gram-positive inhibition zones ranged between 21 and 23 mm and MICs ranged between 0.21 and 1.33 mg/ml. Inhibition zones of Gram-negative bacteria ranged between 11 and 18 mm and MICs between 0.42 and 8 mg/ml. Acid-fast bacteria Mycobacterium phlei had inhibition zones between 16 and 17 mm and MICs between 0.33 and 2.33 mg/ml (Shohayeb *et al*., 2013).

Antibacterial activity of *Conocarpus erectus* leaves extracts was qualitatively evaluated by agar well-diffusion method against gram positive bacteria *Staphylococcus aureus* and gram negative bacteria *Pseudomonas aeruginosa and Acinetobacter baumannii*. The best effect was seen on *Staph. aureus* Fig. 2. (Shaimaa, *et al*., 2019).

Conclusion

Conocarpus erectus, used traditionally for many diseases, has thoroughly been evaluated only for its antioxidant, Hepatoprotective, anticancer and antimicrobial activities *Conocarpus* leaf extract is rich in the phytochemical contents responsible for its medical treatment activities that provide beneficial effects as a good source to combat many diseases. *Conocarpus erectus* L. extract offers a high antibacterial agent against Gram-positive and Gram-negative bacteria.

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