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A review on *Ficus sycomorus*: A potential indigenous medicinal plant in Oman

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ABSTRACT

Higher plants have been used worldwide as natural medicine for long time to cure human diseases. About 80% of people globally use plants as safe sources of drugs to cure human diseases through different complementary medicine system. In Oman, there are plenty of plant sources with significant pharmacological activity. One of the available indigenous medicinal plants, *Ficus sycomorus* (FS), in Oman belongs to the Moraceae family. The plant contains different groups of biologically active compounds which are responsible for the biological activity. The selected Omani species showed different pharmacological activities and used traditionally to treat different diseases. Several research studies on biological, pharmacological and isolation of bioactive compounds have already been done on different species of *Ficus* worldwide. However, only a few such research studies have been conducted on the Omani *Ficus* species. Therefore, the aim of this present review is to evaluate the current biochemical and pharmacological status of the Omani FS species. Our intention in this study is to inform the third world generation regarding the toxicity, pharmacological activity and phytochemicals of the Omani FS species. The present brief review includes its taxonomy, pharmacological activity, phytochemicals and also its potential uses. In this context, the plant itself or extracts and isolated active compounds could be used as novel therapeutic medicine to treat different chemotherapy patients.

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1. Introduction

1.1. Plant description

Ficus sycomorus (FS) is a traditionally used medicinal plant that has been cultivated globally since the ancient times. It originated from Africa, but is currently distributed in almost all tropical countries. The plant belongs to the Moraceae family (Sheikha et al., 2015; 2015; Afaf et al., 2015) and has about 40 genera. The selected family has more than 800 species. The plant species also has several sub-species. Most of species of the selected plant are available in the Gulf region including Oman. Among them, *Ficus sycomorus* (FS) is the most available species throughout the Oman. The English name is Fig, the Arabic name is “Tin” and Bangla name is Dumor. The Holy Quran indicates the importance of the selected medicinal plant, “fig”, by naming one Chapter as “At-Tin”. It is one of the wonders of the Holy Quran. Due to the importance of the plant, it has been mentioned in the Holy Quran in different Surahs like Al-Momeenoon, Al-Rehman, Al-Baqara and Al-Inaam (Sheikha et al., 2015). The common name of *Ficus sycomorus* is fig and it grows well in tropical climates. The plant gives us flowers and fruits throughout the year. The plant grows to a height of about 10 to 20 m and has branches. In India, the plant can be more than 30 m tall. The branches start from the lower parts of the stem and make shapes like umbrellas. The leaves are heart-shaped, spirally arranged and about 10 to 14 cm long. The leaves are dark green with yellow veins. The fruit is round-shaped and has high nutritive value. The fruit is green and is about 2 to 3 cm in diameter (Afaf et al., 2015). It turns into yellow or red colour when it ripens. Several hundreds to thousands of seeds are present in the fruit and it is very tasty. Sometimes, the bark is green, but other times it is yellow with white latex (Singh et al., 2011). The picture of leaves, fruits, barks and flowers are presented in Fig. 1.

1.2. Synonyms

The selected plant is a thick-branched wide-spreading tree. It is called as shade plant. It originates from Africa. However, nowadays it is available all over the world due to its traditional use in the treatment of human diseases. All parts of this plant are medicinally important. The selected plant “Tin” is elaborately discussed in the Holy Quran Para 30 Surah 95 and Ayat 1 (Maryam et al., 2015). According to the first word of this Surah its name is “Al-Tin”. In addition, the importance of the plant is also mentioned several times in the Holy Bible. Few synonyms available globally are as follows:

1. Sycamore fig
2. Genus Ficus
3. Mulberry fig
4. Sycamore
5. Fig tree
6. Ficus

1.3. Taxonomic classification

Domain: Eukaryota; **Kingdom:** Plantae; **Subkingdom:** Viridae-plantae; **Phylum:** Tracheophyta; **Subphylum:** Euphyllophytina; **Infraphylum:** Radiatopses; **Class:** Magnoliopsida; **Subclass:** Dilleniidae; **Superorder:** Urticales; **Order:** Urticales; **Family:** Moraceae; **Tribe:** Ficeae; **Genus:** *Ficus*; **Species:** *Ficus sycomorus*.

1.4. Distribution of plant

The selected plant is native to African countries and mostly grows well in tropical countries including Oman. Naturally, it grows well in Lebanon. It also grows well in the Arabian Peninsula (Maryam et al., 2015). It is also found in Cyprus, Madagascar, Israel and Egypt. Nowadays, the global climate is changing rapidly, therefore, it is also found in some rainfall areas. In the Gulf region and some western countries, it is commercially cultivated. Its fruit is a valuable crop globally. There are some other species available in Indian region, which are very big in size and cover a lot of area. They grow very first and the fruits are very delicious with significant nutritive values. Some species are available in Oman and they are used as medicine through food supplements.

1.5. Traditional use

According to the Holy Quran, the selected plant species is used to treat different disorders. All plant parts of FS are pharmacologically active and used in traditional and modern medicine to treat different disorders. Previous several studies showed that the plant has significant activity and it is used for the treatment of various ailments. The selected plant species are used as folk medicine by different traditional systems for the treatment of various sicknesses related to different systems like the CNS, ANS, cardiovascular system, fertility system etc. (Singh et al., 2011). Due to its significant pharmacological potency, the plant is used to treat different infections (Farsi et al., 2013), GIT problems, various inflammations (Slatnar et al., 2011; Rønsted et al., 2007), diabetes (Farsi et al., 2013; Choo et al., 2012; Ilyanie et al., 2011; Adewole et al., 2011; Bhaskara et al., 2002) and cancer (Mawa et al., 2013). Nigerian people use the *Ficus platyphylla* species traditionally for the treatment of epilepsy (Chindo et al., 2009). In Ayurveda system, the Indian people use the *Ficus racemosa* species to treat diabetes, liver, diarrhoea, skin inflammation, hemorrhoids, cardiovascular diseases and urinary tract infections (Ahmed and Urooj, 2010). The *Ficus glomerata* species is also used in Ayurveda system to cure dysentery, menorrhagia and hemoptysis (Subhaktha et al., 2007). On their part, the Omanis use the selected plant species to treat various ailments like coughs, diarrhoea, skin infections, stomach disorders, liver diseases, epilepsy, tuberculosis, lactation disorders, helminthiasis, infertility and sterility (Subhaktha et al., 2007; Hassan et al., 2007; Hedberg and Staugard, 1989).

1.6. Plant collection

In Oman, there are plenty of *Ficus* species available. However, the selected plant species were collected from Al Sharqiyah and Al Batinah regions. The plant samples were collected in November 2015. The plant was collected in the morning hours to avoid the degradation of chemical compounds. The morphological characterization of the collected plant sample was done by the local and also from websites (Sheikha et al., 2015).

1.7. Sample process and extraction

All collected leaves and fruits samples were washed with water to remove dust and other unwanted particles. Then the leaves and fruits were separated and dried under shade at ambient temperature for one week. The dried samples were ground into coarse



Fig. 1. Pant picture.

powder and then extracted with methanol. The methanol was evaporated from the extract by using rotary evaporator and extract was dissolved in water. It was transferred into a separatory funnel and extracted with various polarity of solvent with increasing pattern. All the mother solvents were evaporated and the prepared extracts were used for determination of different biochemical, pharmacological and toxicological analyses.

2. Biochemical studies

More than 130 bioactive compounds have been isolated from different parts of *Ficus* species since ancient times (Salvador et al., 2012; Laszczyk, 2009; Yan et al., 2014; Dzubak et al., 2006; Chiang et al., 2005; Chiang and Kuo, 2001; Higa et al., 1987; Chiang and Kuo, 2002; Ao et al., 2009; Ao et al., 2008; Kuo and Li, 1997). Most of the compounds were isolated from the aerial

and root parts by the researcher. The isolated compounds are different types of terpenoids, flavonoids and phenolic derivatives (Yan et al., 2014; Dzubak et al., 2006; Chiang et al., 2005; Chiang and Kuo, 2001). Previous studies showed that *Ficus microcarpa* species contains friedelin, lupeol, oleanolic acid, taraxastene-3 β , 22 α -diol and ursolic acid. The said plant species also contains different derivatives of friedelane, ursane, oleanane, lupane, cycloartane, taraxerane, peroxy and cyclopropyl. The tertaterpenoids four six-rings and one five-ring betulinic acid, betulonic acid, lupeol and lupeol were also isolated from the aerial parts of one of the *Ficus* species. According to literature most of the isolated compounds from the aerial part of FS are high molecular weight compounds (86), triterpenoids (56), phenylpropanoids (13), chalcone (2), flavonoids (8) and phenolic acids (12) (Fig. 2). The number of isolated chemical compounds is increasing tremendously. In addition, the most important metabolic compounds such as flavonoids are isolated from the aerial parts of most of the *Ficus* species. Most of

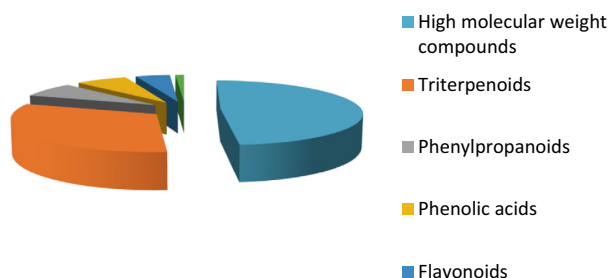


Fig. 2. Total chemical compounds isolated from the FS.

the isolated compounds are take part of different biological activities such as anticancer, antiviral, anti-oxidant, antimicrobial, hepatoprotective and cardio tonic properties (Salvador et al., 2012; Laszczyk, 2009; Yan et al., 2014; Dzubak et al., 2006). Generally, the plant constituents differ from one country to another due to environmental, rainfall and soil conditions. Currently, our research group is also trying to isolate compound from the aerial part of local FS.

3. Pharmacological activities

Ficus species is one of the most important groups of medicinal plants globally. From previous studies, it is showed that all parts of the selected plant give significant activity. This activity is due to the chemical compounds and on the polarity of the compounds (Salvador et al., 2012; Laszczyk, 2009; Yan et al., 2014; Dzubak et al., 2006; Chiang et al., 2005; Chiang and Kuo, 2001; Higa et al., 1987; Chiang and Kuo, 2002; Ao et al., 2009, 2008; Kuo and Li, 1997). Different polarity crude extracts showed different significant activity on antimicrobial, antioxidant, antifungal, cytotoxic, cardio tonic activities (Salvador et al., 2012; Laszczyk, 2009; Yan et al., 2014; Dzubak et al., 2006).

3.1. Antioxidant activity

The antioxidant activity of different polarity crude extracts was determined by well-established modified DPPH method (Sheikha et al., 2015, 2015; Afaf et al., 2015). All the crude extracts showed significant antioxidant activity against DPPH free radical. The results also showed that the most polar crude extract showed the highest activity. The antioxidant activity tended to decrease as the polarity of crude extract decreased. The selected plant contains several active compounds and those are considered as polar compounds because they are isolated by the polar solvent. However, the polar crude extracts contain most of those polar compounds which is responsible for the antioxidant activity. According to literature, the percentage of total flavonoids and phenols compounds was very high in the polar crude extracts (Sheikha et al., 2015, 2015; Afaf et al., 2015). Therefore, those phenolic and flavonoids compounds can accelerate to increase the activity of the polar crude extracts. On the other hand, the lowest activity was observed in non-polar solvent. That means that the non-polar extracts do not contain more active compounds which can directly participate to the biological activities. Actually, not similar antioxidant results also obtained from same and other species from different countries. Our extraction procedure from the plant materials is not similar to others. In addition, the environmental and soil conditions are also not similar. Due to that our experimental results are different from the others. According to our results, the polar crude extracts of FS could be used as natural antioxidant to prevent various incurable diseases.

3.2. Antimicrobial activity

The antimicrobial activity of different polarity crude extracts was determined by the well-known disc diffusion method (Sheikha et al., 2015, 2015; Afaf et al., 2015). All plant crude extracts displayed remarkable activity against selected Gram positive and Gram negative bacterial strains. The polar crude extracts of the locally collected *Ficus* species showed the maximum activity against both Gram (+ and –) bacterial strains. All concentration of polar crude extracts showed activity within the range of inhibition zone 0–13 mm against the Gram (+ and –) bacterial strains. The antimicrobial activity mainly depends on the type of bacterial strains, dose concentration and chemical compounds of the plant extracts. In our selected Omani *Ficus* species, most of the biologically active groups of chemical compounds such as alkaloids, steroids, saponins, tannins, glycosides, terpenoids, and flavonoids are present in the polar extracts which are responsible in increasing the microbial activity (Sekar et al., 2012; Tijjani et al., 2011a, 2011b; Varahalarao and Kaladhar, 2012; Watt and Breyer-brandwijk, 2013). The maximum number of biologically active compounds or maximum concentration of biologically active compounds contributed the maximum antimicrobial activity. The maximum activity was obtained in chloroform extract from the local *Ficus* species (FS) and the minimum activity was hexane extract. Previous reports by other researchers showed that other *Ficus* species collected from other countries also gave similar patterns of activity results. Some of the results from other countries slightly differ from our results may be due to the environmental conditions. The climate of Gulf region including Oman is very hot. Therefore, some of the biologically active compounds which are responsible for activity either decomposed or evaporated due to the high temperatures the plants were exposed to. Therefore, the results obtained from our experiment were somehow low compared to the other reported values (Ao et al., 2009, 2008; Tijjani et al., 2011a, 2011b).

3.3. Cytotoxic activity

The cytotoxic activity of the prepared different polarity crude extracts was determined by brine shrimp lethality method (Sheikha et al., 2015). In our experiment, artificial shrimp and BSL methods were used to determine the cytotoxic activity. We had six different polarities of crude extracts from the Omani *Ficus* species. Among the six crude extracts, the maximum toxicity was obtained in ethyl acetate with an LC_{50} value of 26.82 mg/ml and the minimum toxicity was in butanol with an LC_{50} value of 463.44 mg/ml respectively, in comparison with the negative control DMSO. Again, the toxicity of the crude extracts completely depended on the number of toxic compounds and concentration of the toxic compounds. That means that the number of toxic compounds and the concentration of toxic compounds was increased in the extract and the toxicity of the crude extracts was increased. Not exact similar toxic results were obtained from other countries and other *Ficus* species (Lansky et al., 2008; Wang et al., 1990) since the collected plant samples and the extraction procedures were not similar. In addition, the environmental and soil conditions also are also different. Due to that, our experimental results tend to differ from the others.

4. Conclusion

Several *Ficus* species are widely available in Gulf region including Oman. It has high medicinal values which have been mentioned in both the Quran and the Bible. One chapter in Quran known as “Tin”, mentioned the use of “Tin” as medicine. The plant has special power to cure different diseases. Basically, all parts are

used as medicine to treat different chronic diseases. More than 130 different active and non-active chemical compounds were isolated from the selected FS plant species. Most of the isolated individual compounds showed different pharmacological activities and some of the isolated individual compounds are used commercially as medicine to treat different diseases. Also the plant crude extracts showed significant activity against CNS, ANS, cardiovascular system, fertility system, different infections, GIT problem, various inflammation, diabetics and cancer (Singh et al., 2011; Farsi et al., 2013; Slatnar et al., 2011; Rønsted et al., 2007; Choo et al., 2012; Ilyanie et al., 2011; Adewole et al., 2011; Bhaskara et al., 2002; Mawa et al., 2013). In Oman, the selected plant is used traditionally for the treatment of different infections, inflammations and cardiovascular diseases. Globally, several studies have already been done on all parts of the selected species and scientists are still coming up with new compounds with significant biological activity (Sekar et al., 2012; Tijjani et al., 2011a, 2011b; Varahalarao and Kaladhar, 2012; Watt and Breyer-brandwijk, 2013). Therefore, we have to use the selected plant species for the discovery of new medicine to treat different diseases. In this regard, the present review of the selected plant might help other researchers to carry out further investigations for its better use in pharmaceutical, agrochemical, and cosmetics industries.

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