***Ficus sycomorus* L (Moraceae) plant: A brief review of its phytochemicals, pharmacological propreties and toxicity.**

ABSTRACT

Background:

According to the Holy Quran, the selected plant species is used to treat different disorders. All plant parts of *F. Sycomorus* L 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.

Aim:

Using data from Google Scholar, PubMed, Elsevier, ScienceDirect, Sciencedomain, and Scifinder, a documentary search was carried out aimed at published scientific studies and ethnobotanical and ethnopharmacological literature about its pharmacological characteristics, phytochemical components and toxicity.

Results:

The therapeutic properties of *Ficus sycomorus* are attributed to a variety of bioactive substances, such as phenols, tannins, flavonoids, coumarins, quininous, alkaloids, triterpenes, steroids, saponins, except diterpenes have also been identified. The stem bark, leaves, roots fruits and latex of *Ficus sycomorus* are considered to be very effective in diabetes, jaundice, chest disease, excessive menstrual flow, epilepsy, infertility, diarrhea, ulcers, antidote to snake poison, eaten to increase breast milk production and as neuroprotective, antimicrobial, anti-inflammatory, anti-oxidant, antidiarrheal, Hypotensive, antidiabetic and hepatoprotective agents in both *in vitro* and *in vivo* pharmacological research.

Conclusion:

The findings of this study are useful for developing a monograph on the plant. The data collected can also be used to support the formulation of formulate TAMs (Traditional Improved Medicines) for proposing safe and effective therapeutics.

Keywords: Traditional uses, phytochemistry, pharmacology, *Ficus sycomorus* L.

1. INTRODUCTION

Ficus sycomorus belongs to the Moraceae family, which includes over a thousand species and almost forty genera of flowering plants. This family, also known as the fig or mulberry families, is most frequently found in tropical and subtropical regions [1]. The plant is native to Africa and develop especially in tropical regions such as Senegal.

According to some research, *Ficus sycomorus* contains bioactive compounds in its leaves, roots, fruits, and flowers that can be used either by themselves or in conjunction with other plants for managing diseases like vomiting, convulsive disorder, epilepsy, diarrhoea, and mental illness **[2,3].**

The plant's leaves are used to cure snake bites and jaundice in Tanzania, particularly in rural areas. Its latex is also said to be useful for managing colds, diarrhoea, and chest ailments. *Ficus sycomorus* stem bark extract has an effect on the increasing albino rat's testicular size. *Ficus sycomorus* stem bark decoction is used for treating infertility caused by low sperm counts, although there is a reproductive risk involved. The fruit extract of *F. sycomorus* showed bactericidal activity against several multidrug-resistant bacteria, including *Escherichia coli***,** *Klebsiella pneumoniae*, *Staphylococcus aureus, Pseudomonas aeruginosa, and Proteus vulgaris*, according to antibacterial research carried out to the plant's leaves, stem, roots, seeds, and fruits **[4].**

Standard nitrate reductase assay methods were used to investigate the methanol and aqueous stem bark, root bark, leaves, and fruit extracts of *F. sycomorus* against susceptible strains of Mycobacterium tuberculosis (M-Tb). According to their research, n-hexane fruit extract showed anti-strain effective. However, the susceptible M-Tb strain had no effect by n-hexane leaf, root bark, or stem bark extracts **[5].**

Using the disc diffusion method, the antimicrobial activity of *F. sycomorus* leaf and stem-bark extracts in methanol and acetone was evaluated against human infections that are resistant to many drugs, including *Staphylococcus aureus* and *Acinetobacter baumannii*. With MIC values of 2.5 and 4.9 mg/ml, the study found that the acetone leaf and stem bark extracts had the strongest antibacterial activity against the *Acinetobacter baumannii* isolate and MBC values of 3.8, 9.7 mg/ml, respectively **[6].**

Phytochemical and toxicity evaluation on the stem bark of *F. sycomorus* L (Moraceae) was carried out by Ibrahim *et al.,* (2006) **[7]** on mice with LD_{50} value of 471.1 mg/kg. Its chemical constituents were found to include tannins, resins, steroid glycoside, reducing sugars and saponins. The extract is said to be moderately toxic to mice and therefore can be safely used ethno-medically at lower doses **[8].**

In perspective of the multiple recent findings on this plant, the aim of this review is to give an extensive overview of its traditional uses, phytochemistry, pharmacological activity, and toxicity.

2. Taxonomy, Plant description, Distribution of plant

2.1. Taxonomy [9]

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

2.1.1. Synonyms [10]

Ficus gnaphalocarpa (Miq.) Steud. ex A. Rich.

Sycomorus gnaphalocarpa Miq. **.**

2.1.2. Commons names and local names [10, 11]

English: Sycamore fig , bush fig ; **French:** Sycomore.

Bambara: anabin toro, toro, turu ; **Malinke:** turu, torontoro ; **Moore:** kankanga (tree), kankamsé (trees), kankanma (figs), kankamdé (fig) ; **Peul:** dunéhi, duné, divi, livi ; **Wolof:** gang, bot ; **Hausa:** Baure and **Swahili:** mukuyu, chivuzi.

2.2. Plant description

Ficus sycomorus is commonly referred to as fig and grows in tropical regions. All year long, the plant provides us with fruits and flowers. The plant has branches and exceeds a height of about 10 to 20 meters. The plant can grow to a height of over 30 meters in India. The branches start from the lower parts of the stem and make shapes like umbrellas. The leaves are generally 10 to 14 cm long, heart-shaped, and grouped spiracally. The leaves have yellow veins and are dark green in colour. The fruit has a high nutritional content and a spherical form. The petiole is pubescent with yellowish-grey hairs that become glabrous, 1-6 cm long. The veins are pinnate, prominent, palmate at the base, with 5-7 basal veins and 5-8 pairs of secondary veins that are alternate or subopposite, more or less yellowish, and connected. The fruit has a diameter of almost 2 to 3 cm and is green [12]. When it ripens, it becomes red or yellow in colour. The fruit has hundreds to thousands of seeds, and it tastes delicious. The bark can be green at times or yellow with white latex at other times [13]. Fig. 1 shows images of tree, leaves, fruits and flowers.

A

B

C

D

Fig.1. A: Tree ; B: Leaves ; C: Flowers and D: Fruits

2.3. Distribution of plant

The selected plant is native to African countries and mostly grows well in tropical countries including Senegal. Naturally, it grows well in Lebanon. It also grows well in the Arabian Peninsula **[9].** 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 **[14].** This plant is found on the sides of rivers, in the Sahelo-Sudanian and Sudano-Guinean savannahs, on rich, well-drained soils. It is also found in Mauritania and Senegal (Dakar, Thiès, Kaolack, Fatick and Tambacounda regions), Cameroon, Ethiopia and throughout tropical and southern Africa. It is common and widespread **[15].**

3. Traditional uses

The ethno-medicinal uses of *F. sycomorus* are summarized in table 1.

The Holy Quran asserts that the selected plant species has been used for the treatment of a variety of ailments. Every plant part of *F. Sycomorus* has pharmacological activity and is utilised in the treatment of many kinds of disorders according to conventional and alternative medicine. Several previous investigations showed the plant's potent activity and its efficacy in treating a variety of diseases. South Americans and Africans

apply white latex topically on burns, ulcers, inflammation, and warts in order to promote healing and avoid infections. The boiling bark of *F. Sycomorus* is also used by these inhabitants for medicinal purposes ailments of the chest, respiratory system, and sore throat **[16].** To treat pains, diarrhoea, epilepsy, insomnia, and other psychological disorders, the powdered stem bark is soaked in water for five days and used three times a day **[7, 17, 18]**. The leaves are used as an antidote for snakebite and to treating jaundice. Additionally, the root has laxative and antihelmintic properties **[11, 19, 20].** In Northern Nigeria, its stem bark is used for the treatment diabetes mellitus and other infectious disorders **[8].** Herbalists in Kenya utilise the stem bark for managing the effects of diabetes **[21].** Infertility, oligospermia, and sterility in humans are also treated using its stem bark decoction in Borno State and other parts of Nigeria.

Using *F. sycomorous* leaves and fruits improves lactation **[13].** Decoction of stem bark and leaves helps nursing women produce more milk **[22].** The heavy menstrual flow is treated with the bark decoction **[15].** In Nigeria's northern region, it is used for treating cancer **[23].** F. sycomorus roots has laxative qualities. Consuming *F. Sycomorus* seeds helps in preventing microbiological ailments. The seed's prevent the constipation is avoided by indigestible composition. Also, the fruit can be used to make alcoholic beverages.

Table 1. Traditional uses of *F. sycomorus*

Part used	Traditional uses	References
White latex	Topically for ulcers, burns, inflammation, ringworm, and wart	**[1, 17]**
Stem bark	Sore throat, scrofula, respiratory and chest diseases, epilepsy, diarrhea, insomnia, mental disorders, diabetes, infertility and oligospermia, menorrhagia. It also used to increase breast milk production	**[7, 8, 16, 24]**
Leaves.	Jaundice, antidote to snake poison. Eaten to increase breast milk production. Used as a source of protein for ruminant animals and birds	**[11, 19, 20, 25]**
Root	Laxative and antihelmintic	**[11, 19]**
Fruit	Used to stimulate lactation, preparation of alcoholic beverages	**[11, 13]**

4. PHYTOCHEMICAL CONSTITUENTS

Photochemical investigations have revealed the presence of several classes of secondary metabolites such as condensed tannins, gall tannins, saponins, reducing sugars, aglycone flavones, flavonoid glycosides and anthraquinone glycosides in the bark of this plant **[2, 26].** The leaves of *F. sycomorus* contain other metabolites in addition to those found in the bark, such as sterols and triterpenes, carotenoids, salt alkaloids, anthracenosides, coumarin derivatives, anthocyanins and cardenolides **[27, 28].**

Two benzoic acids have been identified in the bark of this plant: 3- hydroxybenzoic acid and 4- hydroxybenzoic acid **[29].** Proffit and Johnson (2009) **[30]** identified the volatile organic compounds emitted by figs of the Ficus sycomorus species to attract insect pollinators. The method used consisted of first isolating the branches bearing the recipient figs, which were then directly sealed and enclosed in polyethylene terephthalate bags. The headspace technique was used and the volatile compounds were trapped in microtubes loaded into a ChromatoProbe device and analysed by gas chromatography-mass spectrometry. These were fatty acid derivatives, monoterpenes, sesquiterpenes and benzoic compounds (Fig. 2, 3, 4).

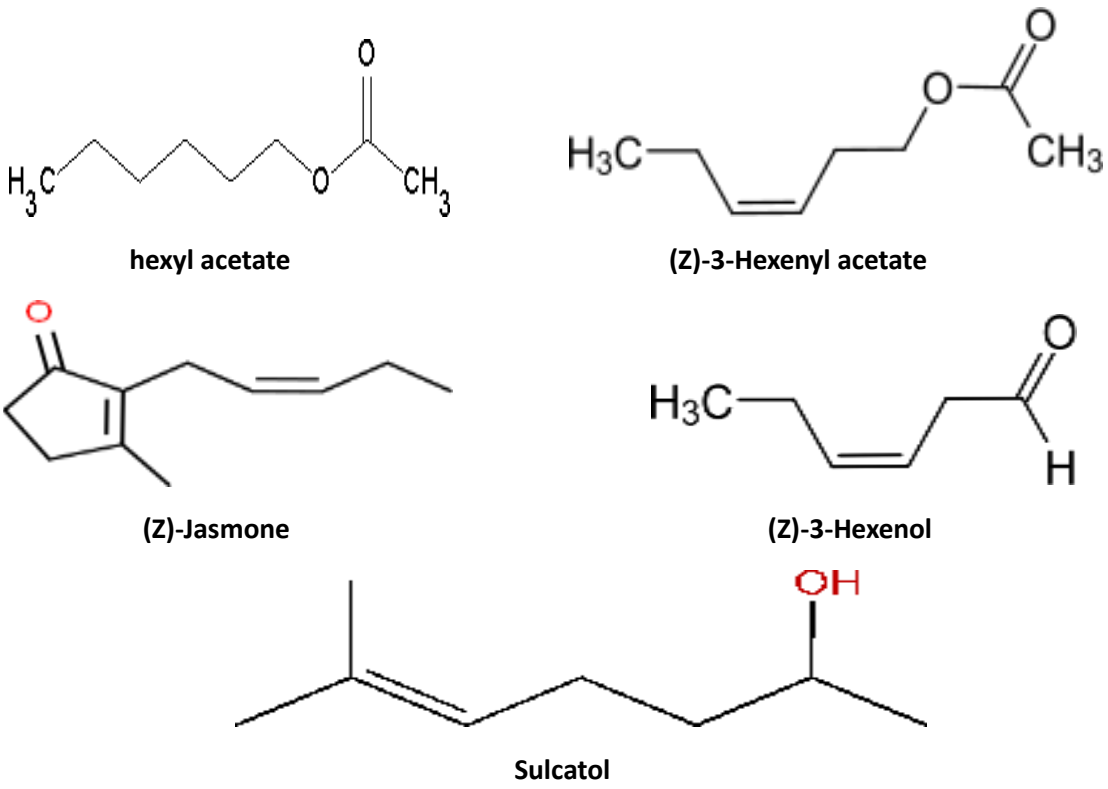
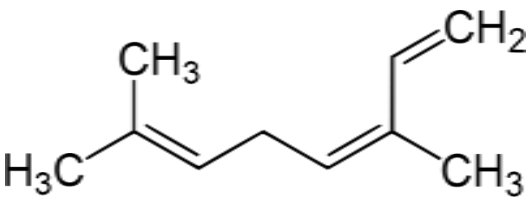
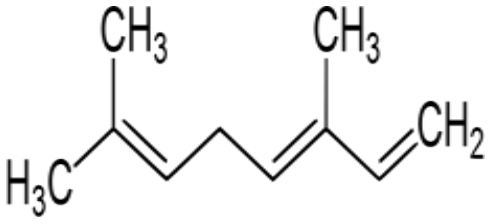


Fig. 2. *Ficus sycomorus* structure of some fatty acid derivatives

Fig. 3 shows F. sycomorus structure of some monoterpenes



(Z)-β-Ocimene



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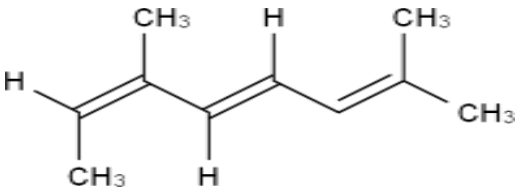
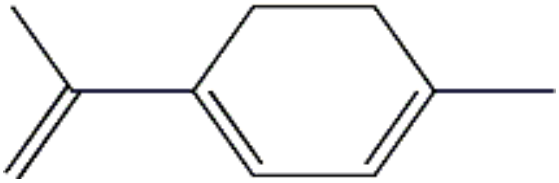
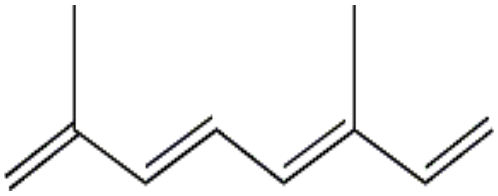


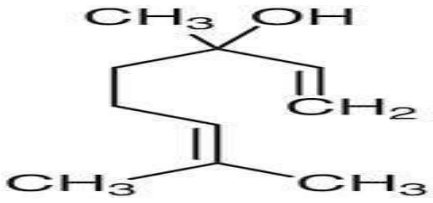
Neo-alloocimene



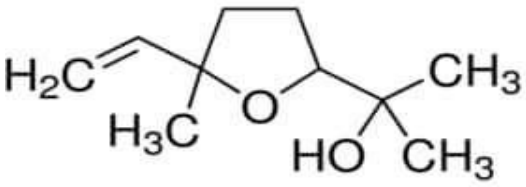
1, 3,8-p-menthatriene



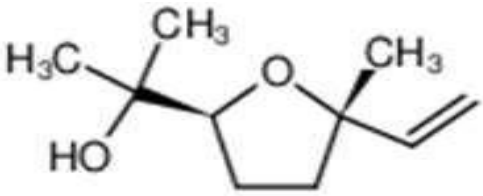
(E,E)-Cosmene



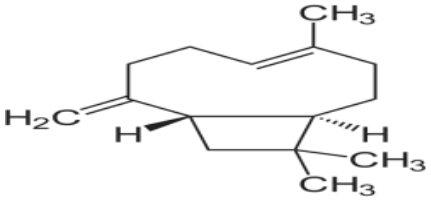
linalol



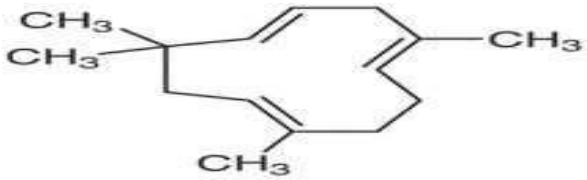
(E)-Linalool oxide



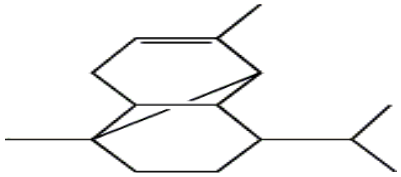
(Z)-Linalool oxide



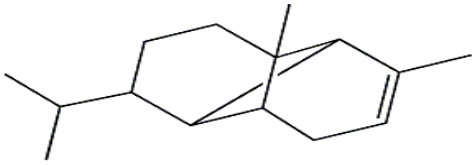
β-Caryophyllene



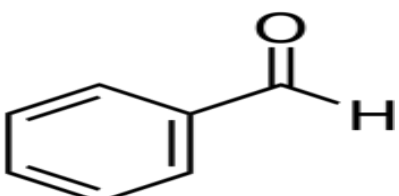
α-Caryophyllene



α-Copaene



α-Ylangene



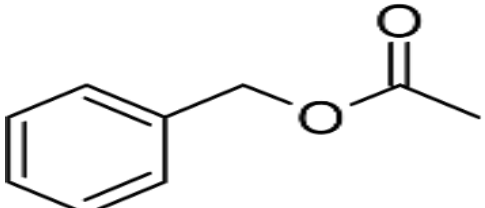


Fig. 5. Ficus sycomorus structure of some benzoic compounds

5. Pharmacological propreties

5.1. Antimicrobial effects

The well-known disc diffusion method was used for determining the antibacterial activity of various crude polar extracts **[12,31].** When tested against specific strains of both Gram-positive and Gram-negative bacteria, all plant crude extracts showed excellent activity. The most powerful activity against both Gramme (+ and -) bacterial strains was revealed by the crude polar extracts of the locally obtained Ficus species. 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. A study on the etheric and acetonic leaf and stembark extracts of *F. sycomorus* were evaluated for their antibacterial activity using dis-diffusion method against 10 clinical bacterial isolates, Liseria monocytogeneses, *Staphylococcus aureus, Bacillus cereus, Escherichia coli O:157, Salmonella typhimurium, Brucella melitensis, Proteus mirabilis, Yersinia enterocolitica O:9, Pseudomonas aeruginosa and Klebsiella pneumonia*. The study revealed that the etheric leaf and stem bark extracts showed no antibacterial activity against all isolates. However, the acetonic stem and leaf extracts inhibited the isolates, with *Salmonella typhimurium* being the most sensitive **[32].** Using the disc diffusion method, the antimicrobial activity of *F. Sycomorus* leaf extract against four bacterial strains (*E. coli, Proteus spp., S. aureus, and H. influenza*) showed that the extract's zone of inhibition was between 0 and 12 mm. The antimicrobial activity increased with increase in polarity **[1].** According to Masaiti *et al.,* 2019 **[33]** antibacterial activity was seen through zones of inhibition starting from 50 mg/ml upwards, with the zones of inhibition increasing as the doses increased. The highest observed zones of inhibition were seen with *F. sycomorus* 500 mg/ml for both aqueous and ethanolic extracts. A difference was

however noted in that a larger zone of inhibition of 6.1mm was obtained with the 500 mg/ml ethanolic extract, as compared to the 5.0 mm observed with the aqueous extract of the same concentration, when tested against *S. aureus*. Antimicrobial activity of methanol and acetone leaf extract of *F. sycomorus* leaf and stem-bark extracts were tested against multidrug resistant human pathogens, *Staphylococcus aureus* and *Acinetobacter baumannii* pathogens using disc diffusion method. From the study, the acetone leaf and stem bark extracts produced the maximum antibacterial activity against Acinetobacter baumannii isolate with MIC values of 2.5, 4.9 mg/ml and MBC values of 3.8, 9.7 mg/ml respectively **[6].**

5.2. Anti-diabetic effects

The stem bark extract of *F. sycomorus* was evaluated for its anti-diabetic properties in alloxan model in mice. Three doses of the extract, 50, 100 and 150 mg/kg significantly reduced blood glucose level when compared to the diabetic control. The extract caused steady reduction in blood glucose level at the first and second hours while a steep decrease was observed at the 3rd and 4th hours at all tested doses **[21].**

5.3. Anti-diarrhea effects

The leaves extract of *F. sycomorus* and *Daniellia oliveri* were studied for antidiarrheal properties. *F. sycomorus* at 50 and 100 mg/kg and *Daniellia oliveri* at 200 mg/kg exhibited 60% and 80% protection respectively against castor oil induced diarrheal in mice. At a dose of 60 and 120 mg/kg, *F. sycomorus* butanol extract showed 100% protection. Butanol extract of *F. sycomorus* (0.16 – 2.56 mg/ml) and Daniellia oliveri (0.4 -3.2 mg/ml) revealed dose dependent relaxation on rabbit jejunum. In mice, the LD_{50} of butanol fraction of *F. sycomorus* and *Daniellia oliveri* were found to be 1141.4 and above 4000 mg/kg respectively **[34].**

5.4. Hepatoprotective effects

Histopathological studies on the hepatoprotective properties of wood, leaf, unripe fruit and root extract of F. sycomorus using N-nitrosodiethylamine and carbon tetrachloride induced hepatocarcinogenesis in rats revealed that the leaf and wood extracts produced remarkable hepatoprotective activities at 400 mg/kg while the stem bark and fruit extract produced moderate and no significant activities respectively **[16].**

5.5. Hypotensive effects

Various parts including, leaves, stem and fresh unripe fruit of *F. sycomorus* were investigated for their blood pressure lowering effects in normotensive rabbits. Results showed that intraperitoneal administration of the unripe fruit extract at 400 mg/kg produced more significant reduction in mean arterial blood pressure when compared to other doses of the extract. The unripe fruit extract was recommended to be used with caution because it produced remarkable arrhythmia **[24].**

5.6. Antioxidant effects

A study by Dahiru and co-workers on the antioxidant properties of methanol stem bark extract of *F. sycomorus* at concentrations of 20, 40, 60, 80 and 100 mg/ml revealed that the extract exhibited DPPH (2, 2-diphenyl-2-picryl hydrazyl) and hydrogen

peroxide (H_2O_2) scavenging activities as well as ferric reducing antioxidant properties (FRAP). The half maximum inhibitory concentration (IC_{50}) of the extract and L-Ascorbic acid in DPPH and FRAP assays were 24.02 mg/ml and 20.00 mg/ml as well as 28.0 mg/ml and 33.05 mg/ml, respectively. The IC_{50} values for H_2O_2 scavenging assay were not specified **[35].**

5.7. Insecticidal and acaricidal effects

Using gas chromatography and mass spectroscopy, insecticidal and acaricidal activities of the bioactive phytochemicals from *F. sycomorus* leaves were determined. The study resulted in the identification of 22 main compounds in the leaf extract, which was more toxic in fumigant toxicity test than contact phase to insects. Concentrations of 0.1, 0.01 and 0.001% were found to be repellent to adult females of *Tetranychus utricae*, *Aphis craccivora* and *Sitophilus oryzae* respectively **[38].** In another study, the leaves and the bark of *F. exasperata* can be used in the management of insect pest infestation of eggplant especially in the organic farming system **[36].**

5.8. Toxicological effects

A study was carried out on the effect of F. sycomorus stem bark extract on semen production in albino rats. The extract was administered at 200, 400 and 600 mg/kg and animals were euthanized on days 10, 20 and 30th after treatment. Administration of the extract resulted to an increase in pH and sperm cell production.17 In a related study, similar doses of stem the bark extract above caused no significant change in mean live body weight, mean testicular size, scrotal diameter of treated rats when compared to control group. No histological lesions were observed in treated group [18].

Toxicological effect of the fruit extract of *F. sycomorus* at 400 mg/kg for 21 days and 800 mg/kg for 10 days in Wistar rats revealed no toxicity on liver, kidney and blood parameters. The extract showed immune boosting property **[4].** Administration of aqueous root extract of *F. sycomorus* to Wistar rats for 2, 4 and 6 weeks at 320, 640 and 1280 mg/kg caused a significant reduction in body weight. There was no significant alteration in liver and kidney weights. However, there was toxicity in liver characterized by cytoplasmic vacuolation of hepatocytes, necrosis, dilatation of central vein and proliferation of bile ducts. The LD_{50} was estimated to be 3.20 ± 0.60 g/kg using Millar and Tainter method **[37].** In-vivo acute toxicity study on methanol stem bark extract of *F. sycomorus* using Lorke's method revealed that it produced toxicity at 1500 mg/kg **[8].**

6. CONCLUSION

Ficus sycomorus plant has a number of culinary and therapeutic uses. A few of its ethnomedical assertions had received scientific confirmation. Using internet databases, this review examined their traditional uses, phytochemistry, pharmacological characteristics, and toxicological effects. However, we have to use the plant species for the discovery of new medicine to treat different diseases. In this regard, the present review of this plant might help other researchers to carry out further investigations for its better use in pharmaceutical, agrochemical, and cosmetics industries.

7. DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

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