Ziziphus mauritiana: Traditional to modern approach of treatment

A Project Report Submitted

In Partial Fulfillment of the Requirements

for the Degree of

BACHELOR OF PHARMACY

Submitted by

SHOEAB AHAMAD

(Enrollment no 19021020139)

Under the Supervision of

Dr.Md Nasar Mallick
Associate Professor
Galgotias University
Greater Noida

Prof.Ajay Pal Singh
Professor
Galgotias University
Greater Noida

Department of Pharmacy
GALGOTIAS UNIVERSITY
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List of abbreviations

WHO: - World health organization

RDA: - Recommended dietary allowances

GCMS: - Gas chromatography mass spectrometer

TB: - Tuberculosis

MCF: - Middle cranial fossa

HDL: - High density lipoprotein

LDL: - Low density lipoprotein

MTT: - (3-(4,5-Dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide

USAN: - United states adopted names council

COX: - Cyclo oxygenase

AA: - Amino acids

GALGOTIAS UNIVERSITY

CERTIFICATE

This is to certify that project work entitled **" *Ziziphus mauritiana:* Traditional to modern approach of treatment"** done by **Mr.SHOEAB AHAMAD**, is a bonafide research work done under the supervision and guidance of **Dr. Md. NASAR MALLICK ,** Associate Professor and **Prof. AJAY PAL SINGH,** Professor, School of Medical and Allied Sciences, Greater Noida. The work is completed and ready for evaluation in partial fulfillment for the award of Bachelor of Pharmacy during the academic year 2022-2023. The project report has not formed the basis for the award of any Degree/Diploma/Fellowship or other similar title to any candidate of any University.

Date:

Prof. Pramod Kumar Sharma
Dean
School of Medical and Allied Sciences

Galgotias University
Greater Noida (U.P.)

BONAFIDECERTIFICATE

This to certify that the project work entitled **"*Ziziphus mauritiana:* Traditional to modern approach of treatment"** is the bonafide research work done by **Mr. SHOEAB AHAMAD**, who carried out the research work under my supervision and guidance for the award of Bachelor of Pharmacy under Galgotias University, Greater Noida during the academic year 2022-2023. To the best of my knowledge the work reported herein is not submitted for award of any other degree or diploma of any other Institute or University.

Dr. Md. Nasar Mallick
Guide
Associate Professor
School of Medical and Allied Sciences
Galgotias University
Greater Noida (U.P.)

Prof. Ajay Pal Singh
Co-guide
Professor
School of Medical and Allied Sciences
Galgotias University
Greater Noida (U.P.)

DECLARATION

I hereby declare that the work embodied in this project report entitled **"*Ziziphus mauritiana:* Traditional to modern approach of treatment"** in Partial fulfillment of the requirements for the award of Bachelor of Pharmacy, is a record of original and independent research work done by me during the academic year 2022-23 under the supervision and guidance of **Dr. Md. NASAR MALLICK** Associate Professor and **Prof. AJAY PAL SINGH**, Professor ,School of Medical and Allied Sciences, Galgotias University, Greater Noida. I have not submitted this project for award of any other degree or diploma of any other Institute or University.

Date: (Mr.SHOEAB AHAMAD)

Place: **Name and Signature of candidate**

Acknowledgement

It gives me a wonderful opportunity to express my genuine gratitude and appreciation to each and every person who has supported me in this accomplishment.

I would like to express my gratitude to **Prof. (Dr.) Pramod Kumar Sharma**, Dean of the School of Medical and Allied Sciences at Galgotias University , Uttar Pradesh, for his guidance, oversight, and significant commitment to this study and, therefore, to this thesis.

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Abstract

Ziziphus mauritiana, often known as Indian jujube or ber, is a member of the Rhamnaceae family. Herbal medicines are the staple of medical treatment in many developing countries. Herbal preparations are used for virtually all minor ailments. Individual herbal medicines in developing regions vary considerably, healers in each region have learned over centuries which local herbs have medicinal worth. One of the underutilized plants with the potential to treat a number of diseases is *Ziziphus mauritiana*. The ancient literature claims that the entire plant, including the fruits, leaves, seeds, and roots, has medicinal properties. However, little is known about the biological activities of leaves. So, this article is focused on potential pharmacological actions and researched anti-cancer properties. The study supported the pharmacological and therapeutic benefits of plants, including their anti-cancer, anti-diabetic, antioxidant, anti-microbial, anti-ulcer, and anxiolytic capabilities. The current study has been aimed to evaluate the anti-cancer properties of the hydroalcoholic and methanolic extracts of leaves and fruit of *Ziziphus mauritiana.* The study revealed that the anti-cancer activity. According to the study's findings, the pharmaceutical industry can investigate the application of an extract from *Z. mauritiana* leaves and fruits with effective biological activity as an antioxidant and anticancer agent.Additionaly, synthesis of nanoparticle for biological water treatment.

Ziziphus species have historically been widely used as medicine to treat a wide range of illnesses and physical conditions, including scabies, acne, mouth and gum irritation, respiratory issues, and chest and lung issues. Additionally, it has been claimed that the leaves of the Ziziphus genus are effective at bleaching the face and neck as well as treating hair growth.

Key Words:- *Ziziphus,* Antioxidant, Nanoparticles, Anti-cancer.

CHAPTER 1

Introduction

A lot of research has been done on medicinal plants because of their potential as food and medicine. The nutritional needs of the human body are met by medicinal plants since they contain carbohydrates, proteins, and lipids. Additionally, these elements are crucial for a number of morphological, physiological, and metabolic processes.[1]

One study found that 100 gramme of a nutritious plant can provide between 10 and 12 percent of the daily recommended dietary allowance (RDA).[2]

A significant source of medicine is plants. From plants, it is possible to isolate a variety of new beneficial therapeutic components and their phytochemical elements (such as antioxidant, hypolipidemic, and hypoglycemic components). There are currently several medications that are made (directly or indirectly) from plants. Due to growing understanding and changing attitudes in the field of health, modern day doctors and pharmacologists have also been steadily adopting the usage of medicinal plants against ailments.[3]

Since the beginning of time, people have shared a fascination in the use of plant-based medicines to treat illness.[4]

Ziziphus mauritiana is an arborvitae that is well renowned for its therapeutic and nutritional properties. In India, it is also known as the "Ber plant."[5]

There are 40 species, which are found worldwide in warm temperate and subtropical climates.[6]

The fruit's flesh varies in color from white to yellow white. Its skin changes color and turns red throughout the ripening stage, and at the last step, it shrivels up.[7]

The fruit of Z. mauritiana comes in a variety of shapes, including round, oblate, and oval. The fruit's weight ranges from 3.8 g to 39.5 g, while its length varies from 1.1 cm to 4.7 cm.[8]

The benefit of this plant in terms of nutrition and medicine has been reported in numerous research.[9]

1.1 Introduction to family Rhamnaceae-

A huge family of flowering plants, Rhamnaceae, or the buckthorn family, includes chiefly trees, shrubs, and some vines.

About 870–900 species and 50–60 genera make up the family. The Rhamnaceae are found all throughout the world, but they are more prevalent in subtropical and tropical areas. Rhamnaceae's fossil history dates back to the Eocene.

Simple leaves might be opposing or alternate and swirling. There are stipules. In several genera, these leaves are transformed into spines, and in some , this transformation is remarkable.The axillary buds on Colletia are unusual in that they have two instead of one, one of which develops into a spike and another grows into a sprout.

The flowers have perfect symmetry from all angles. The flower has 5 distinct sepals (in some cases 4), and 5 distinct petals (rarely 4 or none). Each of the five or four petals has one stamen opposite it, making the stamens and petals identical. Two to three ovules (or one through abortion) are present in the superior ovary.

The majority of edible are berries, fleshy drupes, or nut. While few are air-transformed, animals and birds spread the bulk of species. Tsao (red date), which is the fruit of the jujube tree (Ziziphus mauritiana), is a well-liked fruit in China.

The Rhamnaceae are mostly utilised for aesthetic reasons & in addition to being a supplier of a variety of vibrant green and yellow colours (mostly dyes). Its woods were even the greatest popular material for manufacturing charcoal for use in explosives before the development of modern propellants.

The members of the family include Adolphia, Berchemiella, Ceanothus, Colletia, Discaria, Frangula, Hovenia, Reissekia, Rhamnus, Scutia, Spyridium, Trymalium, and Ziziphus.The American genus Ceanothus, which comprises numerous lovely aesthetic varieties, contains nitrogen-fixing root nodules.[10,11]

1.2 Introduction to genus *Ziziphus* :

In the buckthorn family, Rhamnaceae, the genus Ziziphus has roughly 40 species of prickly shrubs and small trees that are found worldwide in warm-temperate and subtropical climates.

Many are evergreen trees, while some species are seasonal. The leaves have three distinct basal veins, are alternate, and range in length from 2 to 7 cm (0.79 to 2.8 in). The blooms are small, modest, and yellow-green.

It's a drupe that may be eaten that is 1-5 cm (0.39-2.0 in) long, yellow-brown, crimson, or black, globose or rectangular, and frequently highly sweet and sugary. Its texture and flavor are similar to dates.[12,13,14]

1.3 Introduction to species:

Ziziphus mauritiana is a tiny, spiky tree or shrub with many drooping branches and a trunk diameter of at least 40 cm. It also has a spreading crown. It can grow as high as 15 m. The fruit comes in a variety of sizes and shapes. Depending on the variety, it can be 1-2.5 in (2.5-6.25 cm) long and can be oval, obovate, oblong, or spherical. White and crisp describes the flesh. This fruit has a lovely scent and is a little juicy when just a little underripe. The fruit's skin is shiny, tight, smooth, and thin. Where it is most usually seen is in tropical and temperate areas. [15,16,17]

Table 1 – Members of genus *Ziziphus*

Genus	Species	Botanist
Ziziphus	*angolito*	Standl.
Ziziphus	*attopensis*	*Pierre*
Ziziphus	*cotinifolia*	*Reissek*
Ziziphus	*funiculosa*	*Ham.*
Ziziphus	*fungii*	*Merr.*
Ziziphus	*guaranitica*	*Malme*
Ziziphus	*havanensis*	*Kunth*
Ziziphus	*horrida*	*Roth*
Ziziphus	*celata*	
Ziziphus	*hutchinsonii*	

1.4 Distribution:

Ziziphus mauritiana is a small, spiky tree or shrub with many drooping branches and a trunk measurement of at least 0.4 m. It also has a spreading crown. It may reach a height of 15 metres.

The fruit comes in a variety of sizes and shapes. It can be round, oblong, oval, or obovate and can be 2.5.

Depending on the variety, 6.25 cm long. White and crisp describes the flesh. This fruit has a lovely scent and is a little juicy when just little underripe.The skin of the fruit is shiny ,tight and possesses a glossy appearance.Where it is most usually seen is in tropical and southern regions.

It was once only found in India, but it has since spread to many tropical regions, including those in the Pacific, Australia, Afghanistan, and Malaysia. In some places, like Fiji and Australia, it can grow in dense stands and become invasive. It has also turned into a significant North of the nation's ecological pest.These plants are a medium-sized plant that grows quickly, generally a potential height range of 10 to 40 feet.[18,19,20]

Table 2 - Scientific classification:

Kingdom	Plant
Division	Magnoliophyta
Sub division	Angiosperm
Class	Magnoliopsida
Order	Rosales
Family	Rhamnaceae
Tribe	Paliureae
Genus	Ziziphus
Species	Mauritiana

1.5 Uses:

Jujube is a tasty fruit as well as a potent herbal cure. It promotes weight gain, strengthens the muscles, and boosts endurance. It is recommended as a tonic in Chinese medicine to support healthy liver function. It has antid. ,water pill , emol., and expec. properties. Both stringent in nature and febr. the leaves.Also rumoured to promote development of hair. The raisins are anti-cancer, pectoral, cooling, sedative, styptic, and stimulating in addition to having analgesic qualities. These were thought that they may improve digestion & cleanse the blood. These may taken orally to treat hysteria, anaemia, diarrhoea, loss of appetite, chronic exhaustion, and other conditions. The husk is tonic, relaxing sedative, narcotic, and relieves discomfort in the stomach as well as stimulating properties.[21]

This is administered orally to treat excessive sweating, nocturnal sweats, nervous weariness, palpitations, and sleeplessness. Dyspepsia can be treated using the root. Fever has been treated with a decoction of the root. Old wounds and sores are treated using the root's powdered form. The herb is used as a folk treatment for nephritis, anaemia, hypertonia, and neurological disorders. The fruits are used to treat fevers and respiratory diseases as well as wounds and ulcers. The leaves are used as poultices and are beneficial for fever, asthma, and liver problems.[22]

Figure 1 – Leaves of *Ziziphus*

1.6 Chemical constituents:

The leaves (Figure 3) are chemically composed of protein, A.A., alkaloids, terpenoids, fibers, flavonoids, tannins, glycosides, and phenolic compounds.[23]

A study reported the GCMS analysis of *n*-hexane, chloroform and methanol extracts of *Z. mauritiana* leaf. Methanolic extract from leaves showed the presence of diglycerol (0.30%), 2,3-dihydrobenzofuran (0.60%), 1,2-diacetate glycerol (1.44%), methyl palmitate (7.81%), palmitic acid (13.57%), linoleic acid methyl ester (5.98%), phytol (9.78%), methyl stearate (15.59%), lioleic acid (4.75%), α-linolenic acid (14.21%), stearic acid (1.94%), archidic acid methyl ester (1.60%), carbromal (0.76%), 3-methyl piperidine (0.48%), cyclobarbital (0.61%), squalene (12.09%), vitamin E (2.35%), and thymol TMS (1.26%). The chloroform extract contained uneicosane (4.79%), lauric acid (1.66%), myristic acid (2.80%), E-15-Heptadecenal (12.31%), methyl palmitate (2.83%), palmitic acid (38.55%), hentriaconate (3.25%), methyl stearate (2.31%), stearic acid (5.82%), α-nonadecylene (3.77%), bacchotricuneatin C (3.48%), α-tochopherol (10.01%), and vitamin E (5.41%). The *n*-hexane extract of *Z. mauritiana* leaves displayed the presence of myristic acid (0.73%), phytol acetate (1.02%), methyl palmitate (1.01%), palmitic acid (16.26%), linoleic acid, methyl ester (0.45%), phytol (2.52%), methyl stearate (0.53%), linoleic acid (1.37%), α-linolenic acid (26.45%), o-methyl delta-tochopherol (0.47%), octacosane (2.04%), squalene (12.83%), trans-geranylgeraniol (2.34%), 2,4-dimethyl Benzoquinoline (2.28%), α-tochopherol (3.92%), 4-chloro-2-trifluoromethylbenzoquinoline (1.74%), γ-sitosterol (2.72%), and 17-Hydroprogesterone (3.42%). Thus, main components of the n-hex., chlo., and meth. excerpts from Z. mauritiana were found to be omega-6 (26%), hexadecanoic (38%), & methyl ester (15%), respectively.Manly highest concentration of phenolics was detected in the chloroform extract, while the majority of the components in the methanol extract were found to be flavanoids.[24]

Twelve distinct compounds, including daucosterol-6'-octadecanoate, daucosterol-6'-octadecanoate, frangufoline, spinosin, palmitoleic , emmolic acid, stearic acid, docosanoic , and betulinaldehyde, have been identified from the seeds of Z. *mauritiana*, sucrose, and betul These compounds were isolated using silica column chromatography, and their structures were clarified using spectroscopic studies and physico-chemical characteristics.[25]

The fruits of Z. mauritiana are also said to contain a number of bioactive phytochemicals, including phenolic acid and ascorbic acid, according to earlier studies.The pulp of Z. mauritiana has also been reported to contain tannins, cyanogenic glycosides, terpenoids, flavonoids, and saponins [26,27]

Phytochemistry:- From different Ziziphus species, more than 150 cyclopeptide alkaloids have been discovered. The Z. mauritiana contains a variety of substances, including pectin A, glycoside,lipids, alkaloids, and triterpenes.[28]

Pectin A:- Fruits from Ziziphus jujube and Z. mauritiana were discovered to contain pectin A. It was discovered that Pectin A having lactose octaacetate of lactose component. Pharmacological properties of pectin include bile acid binding, decreasing plasma cholesterol, and antidiarrheal action.

Alkaloids:- Several alkaloids are found in the phellem of these types of trees(Z.*mauritiana)*. Zizogenin, type of saponin, was discovered in Z. mauritiana. The cortex of this plants were used for the isolation of cyclopeptide alkaloids that are commonly known as A, B, C, F, G & H of mauritiana. Frangufoline , amphibians (its various types also) & J type of mauritiana were also discovered.

Triterpenoic acid:- From Z. mauritiana, various different triterpenoic acids have been isolated. Cytotoxic effects are produced by terpenic acid that are also extracted from the roots of these trees. Triterpenes such as colubrinate , ethyl alcohol , quinic acids and its derivatives , olenolic acid, zizybronalic acid, and pentacyclic triterpenoid. That is called betulinic acid.

Betulinic acid:- Betulinic acids are physiologically active components that has shown to be selectively toxic to a certain type of tumour in terms of quantity. Moreover, it has been discovered that betulinic acid has antibacterial and anti-inflammatory properties.

Alkaloids:- Phosphatidylcholines are found in the seed and pericarp; however, the principal active ingredients in the seed are phosphatidyl glycerol and different types of fatty acids. Some Ziziphus species contain more than 150 cyclopeptide alkaloids. The Z. mauritiana plant contains the cyclopeptide alkaloids, which have sedative, anti-microbial, anti-diabetic, anti-plasmodium, analgesic, anti-conversant, and anti-inflammatory properties

1.7 Nutritional Values:-

Nutrients are abundant in Z. mauritiana fruit. Its edible part has an apple's worth of iron, given that iron is necessary for the body to transmit oxygen, that's an established fact. Additionally, studies have demonstrated that this fruit's edible components have higher concentrations of Vitamins and mineral compounds, including Fe, Zn, Ca, salt, Mg, and Vit. C, among others. Additionally, research shows that 100 grams of pulp have between 0.070 and 0.165 gm of Vit. C, and the other hand edible parts have higher levels of vitamin A and B complex. [29,30]

Fruits of Z. mauritiana give 20.9 kcal per 100 grammes of pulp, additionally nutrients. Proteins, carb., and micronutrients like Vit. C, zinc, iron, copper, phosphorus, salt, potassium, and calcium are all abundant in the fruit of this plant (Ca). The fruits of Z. mauritiana become a significant component of the diet in Zimbabwe during the growing season. Ber's edible part comes in both sour and sweet varieties. The weight of the dry contents of the edible section in 100 grammes of Ber (sour and sweet) varies from 21.1 g to 24.1 g. Crude fibre ranges from 4.9 to 7.3 grammes per 100 grammes of edible part dry weight, while crude proteins range from 7.9 to 8.7 grammes per 100 grammes (79.5 g to 83.2).The fruits of Z. mauritiana were found to have an energy value of 1516–1575 kJ per 100 g and to be high in vitamin C (15 mg–43.8 mg per 100 g).[31]

A collection of the amounts of various nutrients found in Z. mauritiana as reported by other investigations is shown in Table 3.

Table 3 . Concentration of Different Nutrients in 100 Grams of Fruit of *Ziziphus mauritiana*

Nutrients	Conc. In mg / 100 g of fruit
Calcium (Ca)	160-254
Potassium (K)	1865-2441
Magnesium (Mg)	83-150
Sodium (Na)	185-223
Phosphorus (P)	87-148

Iron (Fe)	2.1-4.3
Zinc (Zn)	0.6-0.9
Copper (Cu)	0.7
Manganese (Mn)	1.6

CHAPTER 2
Literature Review

Carol et al. (2012) Ziziphus mauritiana is cultivated to some extent throughout its natural range but mostly in India where it is grown commercially and has received much horticultural attention and refinement despite the fact that it frequently escapes and becomes a pest. The dried fruits are used as anodyne, anticancer, pectoral, refrigerant, sedative, stomachache, styptic and tonic. They are considered to purify the blood and aid digestion. The root is used in the treatment of dyspepsia. A decoction of the root has been used in the treatment of fevers.

Yahia et al. (2020) The aim of the present study was to screen the content of total polyphenols, flavonoids, and condensed tannins together with the radical scavenging capacity and the antimicrobial activity of leaves, fruits and seeds extracts of Z. lotus and Z. mauritiana from different localities. Results showed that leaves extracts presented the highest phenolic compounds content for both species. Leaves extract of Z. mauritiana possessed the highest total antioxidant capacity. The antimicrobial tests showed that leaves extracts of Z. mauritiana and Z. lotus from Oued Esseder exhibited the highest activity against four bacterial strains.

Shivani et al. (2018) The study aimed to synthesize and characterize silver nanoparticles using aqueous leaf extract of Ziziphus mauritiana and their biosensing application along with the FRAP test.The silver nanoparticles were synthesized using 0.01 M of AgNO3 stock solution.The synthesized nanoparticles were characterized using UV-spectroscopy.The silver nanoparticles were formed within 15-20 minutes as indicated by their pale yellowish color. Ziziphus mauritiana leaf extract act as both reducing agent and stabilizing agent.Silver nanoparticles were synthesized and their stability was checked for 8 days with sample placed at room temperature.

Hamiduzzaman et al. (2014) The purpose of the present study was to evaluate the neuropharmacological, analgesic, antidiarrheal and antimicrobial activity of methanolic crude extract of Z. mauritiana leaves in mice model.Dried methanolic extract was partitioned into pet ether, carbon tetrachloride, chloroform and aqueous soluble fractions. Among all the fractions, methanolic extract at a dose of 200 and 400 mg/kg body weight revealed 27.6 and 29.6 minutes of onset of sleeping; 79 and 89.8 minutes of total sleeping time where control group showed 15.8 minutes of onset of sleeping and 118.6 minutes of total sleeping time.

CHAPTER 3
Aim and Objective

Aim

The aim of this study is to provide research and review investigations for treatment of various diseases for traditional to modern approaches. Additionally, the study also provides study of synthesis of nanoparticles from plant extract for water treatment.

Objective

- Explaining the historically used as medicine to treat various illness and physical conditions.
- Describing various study support for pharmacological and therapeutic benefits of *Z.mauritiana.*
- Demonstrating the synthesis of nanoparticles and its excellent water purification abilities, indicating the plant's potential in the development of eco-friendly methods for water treatment.
- Assessing the anti-cancer and anti oxidant properties of the *Z.mauritiana'*s leaves and fruits.
- Extraction of leaves and fruits of *Z.mauritiana* for determination of their component and activities.

CHAPTER 4
Pharmaceutical properties

Plants are sources of many natural drugs and are useful for the treatment of chronic diseases.More than 60% of clinical therapeutics developed worldwide are thought to have been influenced by herbal remedies and their compounded medications.

According to WHO data, 80% of the world's population depends on medications made from plants. Similar to this, Z. mauritiana has developed a specific reputation for the treatment of numerous disorders. For instance, its leaves are used to treat blood-related illnesses including anaemia and TB. Additionally, buffalo milk and the juice from its leaf are said to be a good treatment for smallpox. Its leaves' paste is applied to wounds to relieve burning feelings. Traditionally, patients are given a blend of fresh Z. mauritiana leaves and cumin to cure urinary tract infections. Additionally, the cortex of this plant is used to medicate in case of diarrhoea when combined with cow's milk. Traditional therapists counsel patients to keep a fresh cortex part of Z. mauritiana inside the mouth to relieve throat hoarseness [32,33,34]

Almost all of this plant's parts have the potential that can be used as medicament in various illness. For instance, dysentery & diarrhoea are typically treated with its roots and stems. This plant's root bark also works well as an analgesic, anti-inflammatory, and anti-allergic agent. Z. mauritiana is also particularly effective in treating pregnancy-related issues like nausea, vomiting, and discomfort in the abdomen. Z. mauritiana leaves can also be used to treat conditions like asthma, fever, and liver problems. Additionally, it has been demonstrated through experimentation that certain Z. mauritiana extracts have strong anti-cancer, anti-inflammatory, and anti-diabetic properties and had a lengthy use heritage in traditional cuisine, medicament, health care, and digestion improvement. It was discovered that this plant has some medical qualities, including antibacterial, antioxidant, and anti-inflammatory effects.[35-38]

Antioxidant potential :-

One of the many factors contributing to the rising global mortality rate is cancer. For the treatment of cancer, numerous therapeutic approaches have been developed. These techniques include therapies like chemotherapy, which has a number of negative impacts on a body's healthy tissues. Therefore, it has become necessary in the modern day to create alternative

therapies for such fatal disorders. In this sense, plant extracts provide a variety of intriguing results.[39]

Increased levels of oxidants cause oxidative stress, which interferes with a body's normal cellular responses. If this condition persists, many diseases may develop as a result (like cancer). Antioxidants are used to treat this disorder. Antioxidants are substances that can prevent, slow down, or obstruct aerobic reactions by scavenging free radicals (by donating electron or atom, quenching oxygen in triplet, and singlet form and chelating metals). They are essential for extending the time that food can be stored. Additionally, they support the therapy of diseases like cancer, ageing, and inflammation.[40]

Due to their antioxidant impact, these naturally occurring plant molecules, or phytochemicals, have the potential to prevent a wide range of ailments.Ziziphus mauritiana has been shown to have antioxidant properties in numerous studies.According to studies some components that are presents in higher concentration manly phenols and Vitamins components (generally vit.C) are responsible for the good antioxidant and H2O2 scavenging capabilities [41,42]

Researchers also observed that the fruits, leaves, and seeds of Z. mauritiana contain roughly eight distinct flavonoids.Additionally, according to researchers, this plant contains phenolic acids with sugars and various biomolecules.The leaves of these plants contain a substantial amount of phytochemical components, which have significant antioxidant and antibacterial activity, according to previous study. These bioactive phytochemical components may be isolated and purified to make even more effective antioxidants.It has been claimed that this plant's methanolic seed extracts are notably efficient against malignant cells.It was discovered that seed extracts in ethanol might stop HL60 cells from proliferating [43]

Antimicrobial Activity:-

It was discovered through the examination of Z. mauritiana leaf extracts that it exhibits antibacterial action against several microbes. There are numerous antibacterial elements in the Z. mauritiana plant that can be employed in the treatment of microbial illnesses. For instance, the methanolic and ethanolic extracts of Z. mauritiana leaves exhibit a wide spectrum of antibiotic activity against several bacteria, including Klebsiella pnemoniae, Escherichia coli, Streptococcus pyogenes, and Staphylococcus aureus.[44]

It was discovered that the pulp of Z. mauritiana fruit contains a wide variety of phytochemicals, and as a result, it (crude and fractionated extracts) has antibacterial potential. According to some research on Z. mauritiana, secondary metabolites with antibacterial potential, including tannins, terpenoids, and flavonoids, are present.[45]

Several researches have also claimed that Z. mauritiana can be employed as a hepatoprotective and neuroprotective anti-diabetic drug [46]

Antifungal activity:-

Anti-fungal compounds found in Ziziphus mauritiana have been shown to be effective against a wide range of fungi, including Candida albicans and Aspergillus flavus, which are common causes of fungal infections in humans. These compounds are believed to work by disrupting the cell wall of the fungi, which ultimately leads to their death. Studies have also shown that Ziziphus mauritiana extracts can inhibit the growth of dermatophytes, which are fungi that commonly cause skin infections such as ringworm and athlete's foot. This makes Ziziphus mauritiana a promising candidate for the development of natural anti-fungal agents that can be used to treat fungal infections.[47]

Anticancerous properties:-

One of the most valued herbs, Z. jujuba has excellent therapeutic properties and has shown a substantial inhibitory effect on the proliferation of several cancer cells. The current investigation showed that Z. jujuba extract at 1 mg/ml, either alone or in combination therapy, dramatically decreased the proliferation and viability of MCF-7 treated cells in a time-dependent manner. Regarding these issues, Ziziphus fruit extracts' cytotoxic effects on breast cancer cells were reported by Plastina et al. using the MTT method. Huang et al. observed that human liver cancer cells that are extremely resistant to chemotherapy medications showed anticancer effects on this fruit.According to research by Vahedi et al., Z. jujuba extract caused cell shrinkage and detachment in HeLa and Hep-2 cells. We showed through inverted microscopic studies that aqueous extract of Z. jujuba fruit caused some morphological changes in the treated cells after 48

hours, including changes in the adhesion of the treated cells to the plate's surface, a decrease in relative size with a round shape, and an increase in internal complexity. At 72 hours, the treated MCF-7 cells displayed a characteristic apoptotic look.[48]

Antidiabetic activity:-

The antihyperglycemic result of various *Z.mauritiana* (Rhamnaceae) fruit decoction, having petroleum ether, chloroform, acetone, ethanol, aqueous, and crude aqueous, as well as components of petroleum ether and aqueous decoction, were examined in high blood sugar rats that had been overfed glucose. The effectiveness of the powerful antihyperglycemic extracts and fraction at lowering blood sugar levels was tested at two dose levels, 200 and 400 mg/kg, respectively. The efficient extracts and fraction of Z. mauritiana were further put through anti-diabetic investigation in the induced diabetes model that was by toxic chemical alloxan, to validate their efficacy in a higher model. Significant antihyperglycemic and hypoglycemic effects were discovered in the Z. mauritiana aq. extract and non-polysaccharide fraction. It was discovered that the petroleum ether extract only had an hypoglycemic effect. Medicaments of high blood sugar rats with petroleum ether extract, aq. extract, and nonpolysaccharide component of these trees significantly brought back to near-normal levels the elevated levels of urea, haemoglobin, creatinine, serum cholesterol, serum triglyceride, HDL, LDL, and glycosylated haemoglobin. Comparatively, petroleum ether decoction, the aqueous extract & nonpolysaccharide component of the aq. extract were found to be more effective. Non-polysaccharide component's activity is equivalent to the case of the common medication glyburide (USAN). Many trees were make use of traditional medicine to cure diabetes. One of them included research on the aq. extract of *Z.mauritiana* Lam leaves. Wistar rats were given the extract intravenously after being temporarily rendered diabetic by an testing of glucose forbearance at first or also can be tested by injecting Toxic chemical (alloxan) by subcutaneously in next term. Firstly, that was forbearance test it was shown that in result a statrtling drop of high blood sugar level to lower level .In the second case, where toxic chemical (alloxan) produced reults that were identical to those achieved with same dose that was in first case given twice or once in a day.The antidiabetic effect was thus demonstrated in an experimental setting, but it needs to be standardised for widespread usage.[49

Antidiarrhoeal activity:-

Ziziphus mauritiana has been found to possess antidiarrheal properties through a unique mechanism of action. This has been demonstrated in various studies, which have shown that the plant's extracts can effectively reduce the frequency and severity of diarrhea.*Z. mauritiana's* methanolic extract have a great impact on peristalsis (intestinal movement). Castor oil-induced diarrhoea was decreased with Lomotil approximately 70.59%.[50]

Analgesic activity:-

These compounds from plants have been shown to have analgesic effects. The search for alternative analgesic and anti-inflammatory molecules to lessen pain and repair inflammation as rapidly as possible has recently attracted a lot of attention. The tail-flick latency procedure can be used to evaluate the capability and effectiveness of medications that target central nociceptive receptors. When given in greater dosages, MEZ dramatically raised the pain threshold in this investigation, which was utilized to evaluate the central nociceptive activity in mice. Its ability to inhibit the synthesis of prostaglandins and bradykinins in tissues, similar to aspirin, may be the cause of the process.(51,52,53,54)

Rutin, the protein responsible for these actions, has been identified by molecular docking studies. Flavonoids also have anti-inflammatory effects by reducing the synthesis of pro-inflammatory cytokines &modifying the arachidonic acid pathway's activity, including COX, LOX & phospholipase A 2. It has been determined that inhibiting COX-2 is a crucial target for potential anti-inflammatory medications. Under normal physiological conditions, tissues cannot contain COX-2, but when inflammation develops, it is strongly produced. Inflammatory stimuli such tumour necrosis factor, interleukin-1, and lipopolysaccharide can activate or control COX-2. Prostacyclin and prostaglandin E2 are produced by this enzyme and they, respectively, promote localised inflammation and systemic inflammation.(55,56,57)

Neuropharmacological activity:-

The phenobarbitone-induced sleep time is potentiated by the methanolic crude extracts of Z. mauritiana leaves when given in a specific dose manner. Comparatively with the control group,

which exhibited a 15.8-minute onset of sleep and 118.6-minute total sleep time, methanolic extraction at various dosages (200 & 400 mg/kg body weight) indicated 27.6 & 29.6 and 79 and 89.8 minutes of total sleep time. In a dose-dependent way, phenobarbitone sodium causes the hypnotic effect, or induction of sleep, in the methanolic crude extract of Z. mauritiana leaves, which implies a profile of sedative action. The sedative effect shown here is most likely caused by benzodiazepines and similar chemicals in crude extract binding to CNS receptors.The study's experimental results revealed that crudely extracted from Z. mauritiana leaves has a mildly sedative impact on mice, indicating that it may have central depressant properties.[58]

Synthesizing of nanoparticles for biological water filtration using *Ziziphus mauritiana.*

Recent studies have explored the potential of Ziziphus mauritiana as a natural source for the synthesis of nickel-copper nanoparticles. These particles have garnered interest in various fields, including medicine, electronics, and catalysis, due to their unique physical and chemical properties. The synthesis of these nanoparticles involves the use of Ziziphus mauritiana extracts, which contain natural reducing agents that can effectively convert metal ions into nanoparticles. The resulting nickel-copper nanoparticles have been shown to possess enhanced antimicrobial and catalytic activities compared to their bulk counterparts. Moreover, the use of Ziziphus mauritiana extracts for nanoparticle synthesis offers a sustainable and eco-friendly approach, as it eliminates the need for harsh chemicals and high-energy inputs that are typically associated with conventional nanoparticle synthesis methods. This underscores the potential of natural sources like Ziziphus mauritiana for the green synthesis of advanced nanomaterials with diverse applications.The continuation of life on Earth depends on water. The World Health Organisation (WHO) advises consuming only clear water that is free of contaminants, turbidity, and colour.[59]

The contamination of water wells with human as well as animal waste, as well as an increase in industrial and agricultural waste, are all factors that contribute to water pollution. Gastrointestinal and liver illnesses are directly correlated with biological contamination of drinking water.[60]

A review study revealing numerous uses for nanoparticles in the treatment of wastewater was published in 2007 by Tiwari et al. Future nanoscale particle production for waste water treatment using nanoparticles was mostly focused on the copper and nickel metals.[61]

Water with a high concentration of faecal E. coli bacteria had a higher coliform count due to biological contamination. Chlorination is one of many technologies that have been used in the past to clean drinking water. Each of these technologies has advantages and disadvantages. The goal of the current project is to purify drinking water using strips of antimicrobial nanomaterials-coated filter paper. The results of the reaction mixture's colour shift were consistent with the research done by Anjum et al.[62]

Ziziphus mauritiana leaf extract's capacity to lower the metal ion suspension for nanoparticle formation was effectively used. The Kaur et al. work, which established reduction and colour change as the primary parameters for copper acetate nanoparticle production, was compared with the green route's nanoparticle synthesis. A UV-visible spectrophotometer was used to characterise the copper acetate and nickel oxide nanoparticles that were created. The study revealed absorption peaks ofthis work of nanomaterials at 340 nm, which supported an increase in absorption peaks as evidence of improved nanoparticle making. These absorption peaks of copper acetate antiparticles were recorded at 650 nm. Sharma and co.[62-67]

The effectiveness of the nanoparticles' antibacterial properties was also assessed. In earlier studies, copper acetate and nickel oxide nanoparticle-coated strips were used for the biological water purification process; however, copper acetate and nickel oxide nanoparticle-coated strips were found to be equally effective against Gramme negative bacteria in the current investigation. Using a concentration of 100 g per 5 mm disc, Z. mauritiana leaf extract was tested at 14 mm and 18 mm against E. coli and Staph. aureus. The improved antibacterial activity of NiO nanoparticles at 1000 g/mL was connected with the antimicrobial characteristics of nickel oxide nanoparticles. In the current experimental setup, nanoparticles' antibacterial efficiency was assessed at lower doses, but their favourable attitude confirmed their capacity to increase the antibiotics penetration power when combined with nanoparticles.[68,69,70]

CHAPTER 5
Material and Method

Plant Material:-

Ziziphus mauritiana's leaves were gathered in February 2023 at the adjacent Galgotias University, Greater Noida.Collected leaves were verified and authenticated by Dr. Md. Nasar Mallick (Associate professor, Department of Pharmacognosy at Galgotias University).

Fruits of Ziziphus mauritiana were bought from a seller near a local market. Fruits were also verified and authenticated by the same person.

Extraction of samples:-

Extraction was done by Soxhlet apparatus. Two solvents were used in separate processes, one was Hydroalcohol and the second was Methanol. After extraction, the decantation process was done with two different solvents at different times: one was Dichloromethane and one was Hexane. After the decantation procedure, the solvent was evaporated by placing the extract on a water bath. Lastly, marked Eppendorf tubes were used to safely store the extracts.

Procedures:-

Extraction by Soxhlet apparatus using HydroAlcohol as a solvent.

Materials:

Ziziphus mauritiana leaves

Hydroalcohol solvent (mixture of ethanol and water)

Soxhlet apparatus

Filter paper

Cotton

Rotary evaporator

Glassware (flask, beaker, pipettes)

Weighing balance

Procedure-

1.Collection and preparation of leaves: Fresh leaves of Ziziphus mauritiana were collected and cleaned thoroughly to remove any dirt or impurities. The leaves were then dried in the shade until they were completely dry.

2.Weighing of dried leaves: The dried leaves were weighed out accurately, and the weight was recorded.

3.Soxhlet extraction: The weighted leaves were placed in the Soxhlet apparatus, and the extractor thimble was fitted. The Soxhlet flask was filled with 500 mL of hydroalcoholic solvent, ensuring that the level of the solvent was above the extractor thimble. The apparatus was assembled, and the flask was connected to a condenser.

4.Heating the solvent: The flask was heated to boil the solvent. As the solvent boiled, it vaporized and condensed on the cooler condenser, eventually dropping back down into the Soxhlet flask.

5.Soxhlet cycle: The Soxhlet cycle usually runs for several times or until the extractant appears to be colorless or pale yellow.

6.Filtering of extract: After the extraction was complete, the apparatus was disconnected, and the extract was filtered through filter paper to remove any solid impurities.

7.Weighing of the final extract: The final extract was weighed and recorded.

This procedure was carried out in triplicate, and the average weight of the extract was calculated. The extract was then subjected to further analysis to determine the presence and concentration of bioactive compounds. Any limitations of the study, such as the extraction efficiency, were also taken into consideration.

Note: The hydroalcoholic solvent should be prepared by mixing ethanol and water in the appropriate ratio based on the solubility of the desired compounds. The ratio of ethanol to water can be adjusted as necessary for different plant materials and desired compounds.

Same procedure follows for Methanolic solvent extraction of Ziziphus mauritiana leaves.

Extraction of Ziziphus mauritiana fruits:-

Materials:

Ziziphus mauritiana fruit

Solvent (e.g. ethanol, methanol)

Mortar and pestle

Buchner funnel

Filter paper

Rotary evaporator

Glassware (flask, beaker, pipettes)

Weighing balance

Hot plate/stirrer

Procedure:

1.Preparation of the fruits: Fresh fruits of Ziziphus mauritiana were collected and washed thoroughly with water to remove any dirt or debris. The fruits were subsequently chopped down into tiny bits and crushed with a mortar and pestle.

2.Weighing of the fruit powder: The powdered fruit was weighed accurately, and the weight was recorded.

3.Solvent extraction: After transferring the powdered fruit to a container, a sufficient amount of chemical solvent was applied to cover the powder. The flask was placed on a hot plate/stirrer, and the mixture was heated to boiling point. The mixture was stirred continuously for 30 minutes to an hour, ensuring that the solvent was in contact with the fruit powder throughout the process.

4.Cooling of the mixture: The container was taken off the burner and proceeded to cool to ambient temperatures after the given amount of time had passed.

5.Filtration of the mixture: To eliminate any solid components, the fluid was filtered using a Buchner funnel lined with filtering paper. The filtrate was collected in a clean beaker.

6.Concentration of the extract:The filtrate was subsequently sent to a rotary evaporator, where the chemical solution was evaporated until the extract was concentrated while under decreased pressure and mild heat.

7.Weighing of the final extract: After allowing the extract to cool, the finished product were weighed and documented.

Note: The choice of solvent will depend on the desired compounds to be extracted from the fruit. Ethanol and methanol are commonly used for extracting phenolic compounds, while water is used for polysaccharide extraction. The extraction time and temperature can also be adjusted based on the desired compounds and their solubility in the solvent. In this extraction Hydroalcohol and Methanol were used.

Decantation process of extract using Hexane in separating funnel:-

Materials:

Extract of Ziziphus mauritiana leaves obtained from Soxhlet apparatus

Hexane solvent

Separating funnel

Funnel stand

Beaker or container

Procedure:

1 .After the completion of Soxhlet extraction, the thimble containing the plant material was removed, and the extracted liquid was collected in a clean container. The collected liquid was then transferred to a separating funnel. An equal volume of hexane solvent was added to the separating funnel, and the mixture was gently shaken to mix the solvent and extracted liquid thoroughly.

2. The mixture was then allowed to settle for several hours or overnight to allow the two layers to separate. Once the layers had separated, the stopcock at the bottom of the separating funnel was carefully opened, and the bottom layer (hexane layer) was allowed to flow out into a clean container.The aqueous layer, which is the upper layer, has been gathered in a different container.

3. Decantation process was repeated by adding fresh hexane to the separating funnel and shaking the funnel gently.The hexane layer was then decanted as previously once the mixture had a chance to settle. This process was repeated as needed to obtain a clear hexane layer free from any aqueous layer.

4. The collected hexane layer was then subjected to further analysis to determine the presence and concentration of the desired compounds. Any limitations or potential sources of error in the decantation process were also taken into consideration. This decantation procedure was performed in triplicate, and the average result was recorded.

5. The same procedure was followed for dichloromethane solvent for the decantation, both for leaf and fruit extract.

Note: The decantation process can be repeated multiple times to improve the purity of the hexane extract. The extracted hexane layer can be further processed using techniques such as filtration, evaporation, or precipitation to obtain the desired compounds. The choice of solvent will depend on the desired compounds to be extracted from the leaves.

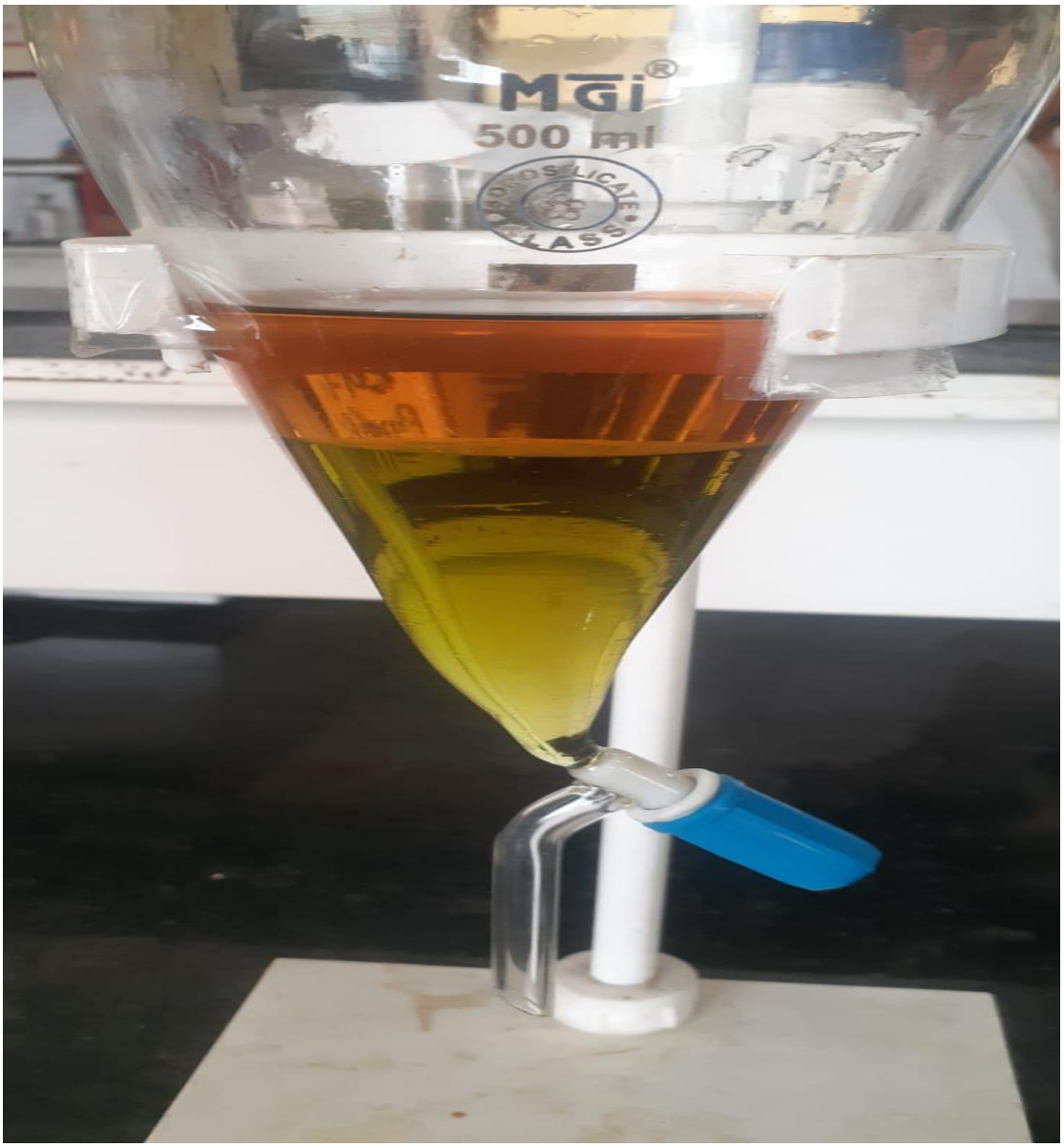

Figure 2 - Decantation process in Soxhlet apparatus

CHAPTER 6
Results and Discussion

Result:- Based on the results of the research on Ziziphus mauritiana leaves and fruit extraction, it has been observed that the plant possesses anti-cancer attributes.Study involved extraction from bioactive compounds from leaves and fruit of the plant, which were then evaluated for their anti-cancer potential.The findings of the research indicated that the extracts obtained from Ziziphus mauritiana leaves and fruit had significant anti-cancer effects on various cancer cell lines.The extracts were shown to cause cell cycle arrest, induce apoptosis, which is a process of programmed cell death, and prevent the development and multiplication of cancer cells.The anti-cancer properties of Ziziphus mauritiana were caused by the existence of various bioactive molecules, including flavonoids, phenolics, and triterpenoids, which have been shown to possess anti-cancer properties. Overall, the findings of the present research imply that the leaves and fruit of Ziziphus mauritiana may contain anti-cancer compounds that might be employed in the creation of brand-new anti-cancer treatments. To completely comprehend the processes behind the anti-cancer properties of Ziziphus mauritiana and to establish the ideal dosages and delivery strategies for these substances, more research is necessary.

Conclusion:- In conclusion, the review of Ziziphus mauritiana's properties has shown its potential as a source of various medicinal benefits , historically been widely used as medicine to treat a wide range of illnesses and physical conditions, including scabies, acne, mouth and gum irritation, respiratory issues, and chest and lung issues. The plant has been found to possess anti-cancer, anti-oxidant, analgesic, anti-diarrhea & anti-diabetic capabilities, qualities make it a strong contender for the creation of fresh medications development and in treatments. Additionally, the synthesis of nanoparticles from the plant extract has proven to be a promising solution for water treatment. These nanoparticles have demonstrated excellent water purification abilities, indicating the plant's potential in the development of sustainable and eco-friendly methods for water treatment.Overall, the findings from this review and research suggest that Ziziphus mauritiana has enormous potential in the field of medicine and water treatment. However, additional investigation is required to completely comprehend the bioactive components of the plant, their modes of action, and their safety and effectiveness in human trials.

Chapter 7

References

1.Kumar M, Puri S, Pundir A, et al. Evaluation of Nutritional, Phytochemical, and Mineral Composition of Selected Medicinal Plants for Therapeutic Uses from the Cold Desert of Western Himalaya Plants. 2021;10(7):1429.

2. Rehman A, Adnan M. Nutritional potential of Pakistani medicinal plants and their contribution to human health in times of climate change and food insecurity. Pak J Bot. 2018;50(1):287-300.

3.Petrovska BB. Historical review of medicinal plants' usage. Pharmacogn. Rev. 2012;6(11):1-5

4.Najafi S, Sanadgol N, Nejad BS, Beiragi MA, Sanadgol E. Phytochemical screening and antibacterial activity of Citrullus colocynthis (Linn.) Schrad against Staphylococcus aureus. J Med Plant Res. 2010;4(22):2321-5.

5.Ashraf A, Sarfraz RA, Anwar F, Shahid SA, Alkharfy KM. Chemical composition and biological activities of leaves of Ziziphus mauritiana L. native to Pakistan. Pak J Bot. 2015;47(1):367-76.

6.Goyal M, Nagori BP, Sasmal D. Review on ethnomedicinal uses, pharmacological activity and phytochemical constituents of Ziziphus mauritiana (Z. jujuba Lam., non Mill). Spatula DD. 2012;2(2):107-16.

7.Dahiru D, Sini J, John-Africa L. Antidiarrhoeal activity of Ziziphus mauritiana root extract in rodents. Afr J Biotechnol. 2006;5(10):941-945.

8.Pareek OP. Fruits for the Future 2: Ber, International Centre for Underutilized Crop. Redwood Books, Wiltshire. 2001;38:15-20.

9.Naseer S, Hussain S, Naeem N, Pervaiz M, Rahman M. The phytochemistry and medicinal value of Psidium guajava (guava). Clin Phytoscience. 2018;4(1):1-8.

10.Patel BH, Upadhyay VR, Muralidharan CM, Judal GS, Effect of various insecticides on honey bees, Apis florea Fabricius in 'ber' (Zizyphus mauritiana Lamk). Current Science,1988; vol. 57(21):1199-1200.

11.en.wikipedia.org/wiki/Ziziphus_mauritiana.

12.Kanitkar, U.K. et al : J. Res. Ind. Med. 3:2, 1969

13.Devi KR, Atluri JB, Reddi CS,Pollination ecology of Ziziphus mauritiana (Rhamnaceae). Proceedings of the Indian Academy of Sciences, Plant Sciences, 1989; 99(3):223-239.

14.Azam-Ali S, Bonkoungou E, Bowe C, deKock C, Godara A, Williams JT. Ber and other jujubes, Ziziphus species. Fruits for Gupta et al., IJPSR, 2012; Vol. 3(3): 818-821 ISSN:0975-8232

15.Singh SP, Wasteland Development. India, (1989), 227 pp.

16.Hocking D, Trees for Drylands. New Delhi, India: Oxford & IBH Publishing (1993).

17.Srivastava S.K. and Srivastava S.D.Structure of Diosgenin, a new sapogenin from Ziziphus mauritiana. Phytochemistry. 1979; 18(10): 1758-1759.

18.Kundu A.D., Barik B.R., Mandal D.N., Dey A.K., Banerji A. Zizybernalic acid, a pentacyclic triterpenoid of Ziziphus jujuba. Phytochemistry. 1989, 28 (11):3155-3158.

19.Pawlowska A.M., Camangi F., Bader A. and Braca A., Flavonoids of Zizyphus jujuba and Ziziphus spina-christi (L) Wild (Rhamnaceae) fruits. Food Chemistry 2000; 112: 858-86

20.Sarfaraz A., Ansari S. H. and Porchezhian E., Antifungal activity of alcoholic extracts of Ziziphus vulgaris and Acacia concinna. Hamdard Medicus. Bait al-Hikmah, Karachi, Pakistan. 2002; 14/15: 42-45.

21.en.wikipedia.org/wiki/Ziziphus_mauritiana.

22.Carol J. Palejkar, Jignesh H. Palejkar, Anar J. Patel, Mayuree A. PatelDepartment of Pharmacognosy, Faculty of Pharmacy, Dharmsinh Desai University, Nadiad-387001, Gujarat, India.

23.Gupta M, Bhandari A, Singh RK. Pharmacognostical evaluations of the leaves of Ziziphus mauritiana. Int J Pharm Sci Res. 2012;3(81):818-821.

24.Ashraf A, Sarfraz RA, Anwar F, Shahid SA, Alkharfy KM. Chemical composition and biological activities of leaves of Ziziphus mauritiana L. native to Pakistan. Pak J Bot. 2015;47(1):367-76.

25.Guo S, Duan J, Zhao J, Qian D, Zhang W. Chemical constituents from seeds of Ziziphus mauritiana. Zhong yao cai. 2014;37(3):432-5.

26.Mbahi M, Mbahi A, Umar I, Ameh D, Joseph I. Phytochemical screening and antimicrobial activity of the pulp extract and fractions of ziziphus mauritiana. Biochem Anal Biochem. 2018;7:1000352.

27. Najafi S. Phytochemical screening and antibacterial activity of leaf extract of Ziziphus mauritiana Lam. Int Res J Basic Appl Sci. 2013;4(10):3274-6

28.Mishra T, Bhatia A, Augmentation of expression of immunocytes function by seeds extract of *Z. mauritiana*(lamk). J Ethnopharmacol. 2010;127:341-5.

29.Bal J, JS B, SS M. Ascorbic Acid Content of Ber During Growth and Maturity. 1978:238-239.

30.Tiwari R, Banafar R. Studies on the nutritive constituents yield and yield attributing characters in some ber (Zizyphus jujuba) genotypes. Indian J Plant Physiol. 1995;38:88-9.

31.Butt SZ, Hussain S, Munawar KS. Phytochemistry of Ziziphus mauritiana: An overview of its nutritional and pharmaceutical potential. Sci Inquiry Rev. 2021;5(2):01–15.

32.Peng W-H, Hsieh M-T, Lee Y-S, Lin Y-C, Liao J. Anxiolytic effect of seed of Ziziphus jujuba in mouse models of anxiety. J Ethnopharmacol. 2000;72(3):435-41.

33.Oudhia P. Medicinal Herbs of Chhattisgarh, India Having Less Known Traditional Uses 64. Peela Gulmohar (Peltophorum pterocarpum, family: Caesalpiniaceae). Research Note. 2003;395.

34.Adzu B, Amos S, Wambebe C, Gamaniel K. Antinociceptive activity of Zizyphus spina-christi root bark extract. Fitoterapia. 2001;72(4):344-50

35.Deshpande MS, Tondare PR, Paygude SV, Apte KG, Parab PB. Evaluation of antioxidant, anti-inflammatory and adipocyte differentiation inhibitory potential of Ziziphus mauritiana bark extract. J Pharmacognosy. 2013;5(5):205-10.

36.Nakayama T, Suzuki S, Kudo H, Sassa S, Nomura M, Sakamoto S. Effects of three Chinese herbal medicines on plasma and liver lipids in mice fed a high-fat diet. J Ethnopharmacol. 2007;109(2):236-40.

37.Pisha E, Chai H, Lee I-S, et al. Discovery of betulinic acid as a selective inhibitor of human melanoma that functions by induction of apoptosis. Nat Med. 1995;1(10):1046-51.

38.Kumar S, Ganachari M, Nagoor V. Anti-inflammatory activity of Ziziphus jujuba Lam leaves extract in rats. J Nat Remedies. 2004;4(2):183-5.

39.Yu F, De Luca V. ATP-binding cassette transporter controls leaf surface secretion of anticancer drug components in Catharanthus roseus. Proc Natl Acad Sci. 2013;110(39):15830-5.

40.Dalleau S, Baradat M, Gueraud F, Huc L. Cell death and diseases related to oxidative stress: 4-hydroxynonenal (HNE) in the balance. Cell death and differentiation. 2013;20(12):1615-1630.

41.Afroz R, Tanvir E, Islam MA, Alam F, Gan SH, Khalil MI. Potential Antioxidant and Antibacterial Properties of a Popular Jujube Fruit: Apple Kul (Ziziphus mauritiana). J. Food Biochem. 2014;38(6):592-601.

42.Al Ghasham A, Al Muzaini M, Qureshi KA, et al. Phytochemical screening, antioxidant and antimicrobial activities of methanolic extract of Ziziphus mauritiana Lam. Leaves Collected from Unaizah, Saudi Arabia Int J Pharm Res Allied Sci. 2017;6(3):33-46

43.Mishra T, Khullar M, Bhatia A. Anticancer potential of aqueous ethanol seed extract of Ziziphus mauritiana against cancer cell lines and Ehrlich ascites carcinoma. Evid.-Based Complementary Altern. Med. 2011;2011:1-12.

44.Najafi S. Phytochemical screening and antibacterial activity of leaf extract of Ziziphus mauritiana Lam. Int Res J Basic Appl Sci. 2013;4(10):3274-6.

45.Dahiru D, Obidoa O. Evaluation of the antioxidant effects of Ziziphus mauritiana lam. leaf extracts against chronic ethanol-induced hepatotoxicity in rat liver. Afr. J. Tradit. Complement. Altern Med. 2008;5(1):39-45.

46.Dahiru D, William E, Nadro M. Protective effect of Ziziphus mauritiana leaf extract on carbon tetrachloride-induced liver injury. Afr J Biotechnol. 2005;4(10):1177-1179.

47.Sarfaraz A., Ansari S. H. and Porchezhian E., Antifungal activity of alcoholic extracts of Ziziphus vulgaris and Acacia concinna. Hamdard Medicus. Bait al-Hikmah, Karachi, Pakistan. 2002; 14/15: 42-45.

48.Zeinab M. Klaab1 , Faizah A. AlMalki, Aziza M. Hassan, Anticancer Activities of Ziziphus Jujuba Extract on Breast Cancer Cells in vitro.

49.Carol J. Palejkar, Jignesh H. Palejkar, Anar J. Patel, Mayuree A. Patel A PLANT REVIEW ON ZIZIPHUS MAURITIANA, Department of Pharmacognosy, Faculty of Pharmacy, Dharmsinh Desai University, Nadiad-387001,Gujarat, India

50. Dahiru, D., Sini J. M and John-Africa LAntidiarrhoeal activity of Ziziphus mauritiana root extract in rodents. African Journal of Biotechnology Vol. 5 (10), pp. 941-945, 16 May 2006.

51. H. Hapidin, N.M. Hashim, M.Z. Kasiram, H. Abdullah, The effects of polyphenol, tannic acid, or tannic acid in combination with pamidronate on human osteoblast cell line metabolism, Molecules 27 (2) (2022) 451 .

52.M. Ghias, S.W.A. Shah, F.A. Al-Joufi, M. Shoaib, S.M.M. Shah, M.N. Ahmed, M. Za-hoor, In vivo antistress effects of synthetic flavonoids in mice: behavioral and bio-chemical approach, Molecules 27 (4) (2022) 1402 .

53.S. Wahid, A. Alqahtani, R.A. Khan, Analgesic and anti-inflammatory effects and safety profile of Cucurbita maxima and Cucumis sativus seeds, Saud. J. Biol. Sci. 28 (8) (2021) 4334–4341 .

54.L.B. Sørensen, P. Gazerani, T. Graven-Nielsen, Nerve growth factor-induced mus-cle hyperalgesia facilitates ischaemic contraction-evoked pain, Eur. J. Pain 23 (10) (2019) 1814–1825.

55. W. Bassiouni, T. Daabees, L. Louedec, X. Norel, A. Senbel, Evaluation of some prostaglandins modulators on rat corpus cavernosum in-vitro: is relax-ation negatively affected by COX-inhibitors? Biomed. Pharmacother. 111 (2019) 1458–1466 .

56.H.G. Moon, Y.S. Kim, J.P. Choi, D.S. Choi, C.M. Yoon, S.G. Jeon, Y.S. Gho, Y.K. Kim, Aspirin attenuates the anti-inflammatory effects of theophylline via inhibition of cAMP production in mice with non-eosinophilic asthma, Exp. Mol. Med. 42 (1) (2010) 47–60 .

57. T. Hanke, D. Merk, D. Steinhilber, G. Geisslinger, M. Schubert-Zsilavecz, Small molecules with anti-inflammatory properties in clinical development, Pharmacology. Ther. 157 (2016) 163–187.

58.H.Md., S.Moniruzzaman, H.Jamal, Neuropharmacological, Analgesic, Antidiarrheal and Antimicrobial Activities of Methanolic Extract of Ziziphus mauritiana Leaves (Rhamnaceae)

59 .Liu J, Yang H, Gosling SN, Kummu M, Flörke M, Pfister S,et al. Water scarcity assessments in the past, present, and future. Earth's Future. 2017;5(6):545-59.

60. Daud MK, Nafees M, Ali S, Rizwan M, Bajwa RA, Shakoor MB, et al. Drinking Water Quality Status and Contamination in Pakistan. BioMed Research International. 2017;2017:1-

61. Tiwari DK, Behari J, Sen P. Application of nanoparticles in waste water treatment 1. 2008.

62. Anjum FR, S. Anam, S.U. Rahman, et al. Evaluation of antibacterial activity of plant based silver nanoparticles in Synergism with Antibiotics. International Journal of Biosciences (IJB). 2018; 13(03): 250-61.

63.Kaur P, Thakur R, Chaudhury A. Biogenesis of copper nanoparticles using peel extract ofPunica granatumand their antimicrobial activity against opportunistic pathogens.Green Chemistry Letters and Reviews. 2016;9(1):33-8.

64. Ashtaputrey S, Ashtaputrey P, Yelane N. Green synthesis and characterization of copper nanoparticles derived from Murraya koenigii leaves extract. J Chem Pharm Sci. 2017;10(3): 1288-91.

65. Sharma P, S. Panta, V. Dave, et al. Green synthesis and characterization of copper nanoparticles by Tinospora cardifolia to produce nature-friendly copper nano-coated fabric and their antimicrobial evaluation. Journal of Microbiological Methods. 2019;160:107–16.

66. Fernando J, Gurulakshmi P. Green Synthesis and Characterization of Copper Nanoparticles and Their Applications. Journal of Nanoscience and Technology.2016: 234-6.

67. Sudhasree S, Shakila Banu A, Brindha P, Kurian GA. Synthesis of nickel nanoparticles by chemical and green route and their comparison in respect to biological effect and toxicity. Toxicological & Environmental Chemistry.2014;96(5):743-54.

68.Mahesh B, Satish S. Antimicrobial activity of some important medicinal plant against plant and human pathogens. World journal of agricultural sciences. 2008;4(5): 839-43.

69. Khashan KS, Sulaiman GM, Ameer A, Kareem FA, Napolitano G. Synthesis, characterization and antibacterial activity of colloidal NiO nanoparticles. Pakistan journal of pharmaceutical sciences. 2016; 29(2).

70.Lu H, Wang J, Stoller M, Wang T, Bao Y, Hao H. An Overview of Nanomaterials for Water and Wastewater Treatment. Advances in Materials Science and Engineering. 2016;2016:1-10.

71.https://www.easyayurveda.com/2015/07/26/ber-fruit-indian-jujube-uses-dose-side-effect-research/

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PP-83

ASSESSMENT OF ANTI-OXIDANT AND ANTICANCER PROPERTIES OF ZIZIPHUS MAURITIANA

Shoeab Ahamad[1], Md Nasar Mallick[1], Ajay Pal Singh[1], Sadaf[2], Kapil Dev[2], Md. Zeeshan Najam Khan[3], Pramod Kumar Sharma1

[1].Department of Pharmacy, School of Medical and Allied Sciences, Galgotias university, Greater Noida

[2]. Department of Biotechnology, Jamia Millia Islamia, New Delhi.

[3].School of Bio Sciences, Apeejay Satya University, Sohna-Gurugram Road, Haryana

Abstract: Ziziphus mauritiana, often known as Indian jujube or ber, is a member of the Rhamnaceae family. Herbal medicines are the staple of medical treatment in many developing countries. Herbal preparations are used for virtually all minor ailments. Individual herbal medicines in developing regions vary considerably, healers in each region have learned over centuries which local herbs have medicinal worth. One of the underutilized plants with the potential to treat a number of diseases is Ziziphus mauritiana. The ancient literature claims that the entire plant, including the fruits, leaves, seeds, and roots, has medicinal properties. However, little is known about the biological activities of leaves. So, this article is focused on potential pharmacological actions and researched anti-cancer properties. The study supported the pharmacological and therapeutic benefits of plants, including their anti-cancer, anti-diabetic, antioxidant, anti-microbial, anti-ulcer, and anxiolytic capabilities. The current study has been aimed to evaluate the anti-cancer properties of the hydroalcoholic and methanolic extracts of leaves and fruit of Ziziphus mauritiana. The study revealed that the anti-cancer activity. According to the study's findings, the pharmaceutical industry can investigate the application of an extract from Z. mauritiana leaves and fruits with effective biological activity as an antioxidant and anticancer agent.

Key Words:- Ziziphus mauritiana, Anti-Cancer, Anti-oxidant.

PP-84

EMERGING ROLE OF FLAVONOIDS IN METABOLIC DISORDERS

Rohit Bhardwaj*[1], Tarun Kumar[1], Ravi Pratap[1], Satyendra Kumar Rajput[1]

[1]. Department of Pharmaceutical Sciences, Gurukula kangri Deemed to be University, Haridwar-249404, Uttarakhand India

+91 9813677348; rohitbhardwaj.aip@gmail.com

Abstract : Flavonoids are plant-derived compounds that have been shown to have a variety of beneficial effects on human health. Recent studies have shown that flavonoids are capable of modulating diabetes and its associated disorders. The emerging role of flavonoids in these disorders has been attributed to their ability to modulate various cellular and molecular targets, including insulin signaling pathways, glucose uptake, lipid metabolism, and inflammation. The flavonoid-mediated modulation of diabetes and its associated disorders is believed to be due to their antioxidant and anti-inflammatory properties. Additionally, they have been shown to modulate the activity of enzymes involved in carbohydrate metabolism, as well as to modulate the release of hormones such as insulin. Furthermore, flavonoids have been found to inhibit the absorption of glucose in the small intestine and to reduce the risk of diabetes complications such as cardiovascular

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