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Pharmacognosic Study and Pharmacological Evaluation of Moringa Oleifera Lam.

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Antibiotic resistance, Moringa oleifera Lam., Extracts, Antimicrobial activity

ABSTRACT:

The emergence and spread of antibiotic resistance as well as the evolution of new strains of disease causing microbial agents are of great concern to the global health community. Effective treatment of a disease entails the development of new pharmaceuticals or some potential source of novel drugs. Commonly used vegetable plants of our community could be an excellent source of drugs to fight off this problem. This study is focused on exploring the antimicrobial properties of the plant- Moringa oleifera Lam. that is commonly being used as traditional medicines. The antimicrobial potential of such plant extracts was screened against some pathogenic microorganisms. In this study, the petroleum ether extract, methanolic extract and aqueous extract of Moringa oleifera Lam. were tested against bacterial strains namely E.coli, Aspergillus niger and Bacillus cereus by agar well diffusion method. The obtained results indicated that the methanolic extract of Moringa oleifera Lam. showed efficacy against bacillus cereus. This study clearly indicates the future applicability of Moringa oleifera Lam. for the control of various diseases.

1. Introduction

Moringa have various species across the globe which are known for their variety of usages few examples of Moringa species are Moringa longituba, Moringa drouhardii, Moringa ovalifolia etc. Moringa oleifera Lam., also known as the 'drumstick tree,' is recognized as a vibrant and affordable source of phytochemicals, having potential applications in medicines, functional food preparations, water purification, and biodiesel production. This plant has several applications in the food, pharmaceutical, cosmetics and food nutrition industries due to its properties (1). Many pharmacological studies have shown the ability of this plant to exhibit analgesic, antipyretic, anticancer, antioxidant, nootropic, gastroprotective, anti-ulcer, anti-obesity, antiepileptic, antiasthmatic, antidiabetic, anti-urolithiatic, diuretic, local anesthetic, anti-allergic, anthelmintic, wound healing, antimicrobial, immunomodulatory, and antidiarrheal properties. These activities may be attributed to phytoconstituents present in its root, stem, bark, leaf, flower, pod, and seeds. Moringa oleifera offers immense value, which can form the basis of drug supplementation, and should be used for the promotion of public health. It may also be considered for the treatment of different diseases as an alternative therapy (2). The multiple biological activities including antiproliferation, hepatoprotective, anti-inflammatory, antinociceptive, antiatherosclerotic, oxidative DNA damage protective, antiperoxidative, cardioprotective, as well as folk medicinal uses of Moringa oleifera are attributed to the presence of functional bioactive compounds, such as phenolic acids, flavonoids, alkaloids, phytosterols, natural sugars, vitamins, minerals, and organic acids. Thus, moringa oleifera is emerging as one of the prominent industrial crops for sustainable biodiesel production in tropical and subtropical countries. In view of the high nutritional, nutraceutical, and industrial values, it is important to compile an updated comprehensive review on the related aspects of this multipurpose and miracle tree. Hence, the present study is focused on the evaluation of pharmacognostic characters, chemical profile of this plant and potency of moringa oleifera extract against different type of microbes.

Journal of Chemical Health Risks

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Moringaceae is a single genus family of shrubs and trees, which comprise of 13 species, distributed in the Indian subcontinent (Moringa oleifera and M. concanensis), Kenya (M. longituba and M. rivae), northeastern and southwestern Africa (M. stenopetala), Arabia, and Madagascar (M. drouhardii and M. hildebrandtii). Moringa oleifera Lam. is a tropical deciduous perennial dicotyledonous tree. The stem is brittle with a corky, whitish-gray bark, with drooping branches, pale green and bipinnate or more commonly tripinnate leaves (30–60 cm long) with opposite, ovate leaflets. Moringa oleifera, the native of the sub-Himalayan mountains of northern India; is now cultivated for a variety of purposes in the whole tropical and sub-tropical regions of the world. recently reviewed the potential of the Moringa oleifera tree, emphasizing its nutritional applications for humans and industrial uses, and also described its propagation methods. It is propagated through cuttings (0.2–1.0 m long), with recommended tree to tree spacing of 1.2 and 5 m between rows (for pod yield), to obtain the desirable population of 1666 trees/ha. For foliage production, cuttings are planted with a close spacing to obtain≈1 million trees/ha. Propagation through seeds is not recommended because of substantial genetic variation through cross-pollination. The Moringa tree grows best in the temperature range of 25–35 °C, under direct sunlight, at an altitude of 500 m, and in slightly acidic to alkaline soil (pH 5.0–9.0); although it can tolerate excess temperature, up to 48 °C, frost in winter, altitude, and a wide variety of soil conditions. Moringa oleifera seeds can be planted just after maturity, as the seeds do not undergo dormancy while retaining viability up to 1 year. The tree starts bearing fruits at an age between six and 8 months, with a low fruit set in the initial one to 2 years, however, the yield increases in the subsequent years. The productivity of the Brazilian genotype was estimated as 45 tons of pods per hectare. The oil yield of 258 kg/ha was recorded from the Indian cultivar (PKM-1), grown in the subtropical north-western region of Argentina, after 3 years of the plantation. India is the largest producer of moringa oleifera fruits (pods) with an annual production of 1.1–1.3 million tons from an area of 38,000 ha. In India, Plants and extracts of their various sections have been used for their medical characteristics and to cure specific ailments as well as general tonics, meals, and other methods to increase the body's immunity and vigor since ancient times. However, since last few decades the interest of researchers has gone up dramatically to understand their detailed compositions and also to explore and establish their potential applications in diverse areas. In fact, it is the need of the hour to leverage the vital power of the nature to combat proliferating diseases like cancer, heart attacks, diabetes, rapid skin aging etc. and upcoming varieties of new alarming health concerns like recent concerns of Coronavirus disease in 2019 (COVID-19), which affects the respiratory system acutely (3).

Different parts like seeds, roots, stem, bark, leaves, flower and fruits of the plant have their own phytochemical compositions and potential medicinal properties. (4). Moringa Oleifera is one of the magical plants considered in India due to its high medicinal properties. However, there is still a lot to unleash the potential of Moringa Oleifera by understanding their phytocomponents and variation in extraction due to solvents, understanding their potential properties and to establish their applications in various fields. The present study is focused to investigate the phytochemical composition of the Moringa Oleifera leaves aqueous and alcoholic extracts. The Moringa oleifera plant provides a rich and rare combination of zeatin, quercetin, kaempferom and many other phytochemicals. The leaves are used as a source of vitamins A and C. They are also good sources of vitamin B and are also a source of minerals. Ethanolic extract of Moringa oleifera leaves contain niazirin, niazirinin, niazininins A and B. Benzoic acid, gallic acid, beta benzaldehyde has been isolated from methanolic extract of Moringa oleifera leaves. An immune enhancing polysaccharide and niaziminin, having structural requirement to inhibit tumor promoter induced Epstein Barr virus activation have been reported from the leaves. The alcoholic extract of leaves of Moringa oleifera was reported to have analgesic activity. Traditionally, the plant is used as antispasmodic, stimulant, expectorant and diuretic.

The word antimicrobial is derived from the Greek words anti(against), mikros (little) and bios (life). It refers to all agents that act against microbial organism. Any substance of natural (penicillin G and penicillin V), semisynthetic (ampicillin and amoxicillin) or synthetic (sulfonamides and quinolones) origin that kill or suppresses the growth of microbes but cause little or no damage to the host. An extremely small living thing that you can only see with a special piece of

Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(1), 2607-2615 | ISSN:2251-6727

equipment (a microscope) and that can cause disease. Antimicrobial agent or drugs: A drug used to treat a microbial infection. “Antimicrobial” is a general term that refers to a group of drugs that includes antibiotic, antifungal, antiprotozoals and antivirals.

Nowadays, multiple drug resistance (MDR) has developed due to the indiscriminate use of commercial antimicrobial drugs commonly used in the treatment of such infectious diseases. adding to this problem, antibiotics are sometimes associated with adverse effects on the host, including hypersensitivity, immune suppression, and allergic response.(5)

Owing to the side effects and the resistance that pathogenic microorganisms build against Antibiotics, many scientists have recently started paying attention to medicinal plants and biologically active compounds isolated from plant species used in herbal medicine. Antimicrobial properties of medicinal plants are being increasingly reported from different parts of the world. however, it is necessary to evaluate on a scientific base, the potential use of herbal medicine for the treatment of infectious disease caused by common pathogens.(6)

MATERIAL AND METHOD

Collection and authentication of plant-

The leaves of Moringa oleifera were collected from the local market of Durg Chhattisgarh in January 2022. The plant was identified authenticated by Dr. Ranjana Srivastava professor of department of botany, govt. T. V. Y. PG. Autonomous college Durg Chhattisgarh.

Preparation of leaf extract

The experiment was conducted in the year 2022 in the Apollo college of pharmacy. 1 Kg of the leaves were washed under running tap water to eliminate dust and other foreign particles and to cleanse the leaves thoroughly and dried.

20-30 grams of fresh leaves were boiled with 200 mL of solvent for 1 hour. The extract was filtered using Whatman filter paper No. 1 and then concentrated in vacuum at 40°-50°C using a rotary evaporator. Evaporation of solvent in the rotary evaporator affords a crude extract of the soluble components and these extracts were subjected to the qualitative phytochemical analysis and antibacterial studies.

Chemicals, Reagents and solvents –

All chemicals, solvents and reagents used were of analytical grade.

Equipment –

Digital binocular microscope, quantitative microscopic measurements which contain eyepiece stage micrometers, and camera Lucida (mirror type), heating mental, thermostatic water bah, thermostatic furnace.

Macroscopic examination of leaves –

According to standard procedure matured 25 leaves are taken for the assessment of morphology of leaves and various parameters such as length, width, apex, margin, surface, colour, odour, taste, types, base, midrib, and size were evaluated.

Transverse section of leaf

To study microscopic characters of T.S. of leaf via the midrib with small portion of lamina are taken which are treated with concentrated HCL and phoroglucinol indicator. The stained sections were observed under binocular microscope and photos were taken.

Determination of analytical standards –

Total ash values

A tarred crucible was dried and cooled was weighed (x). Weigh accurately about 3 g of the powdered drug in a tarred silica crucible. Heated gently until all the moisture had been driven off and all the plant material was completely charred (y). the heat was slowly increased until the residue was free from carbon at 650 degree Celsius and the sample turn white ash. The crucible was removed, cooled in a desiccator and reweighed. (z)

Total Ash value – (Z-X) 100Y

Weigh of empty dish (X)

Weigh of taken drug (Y)

Weigh of dish + ash after complete incineration (Z)

Water soluble ash value –

The ash obtained from the total ash transformed in to 25 ml water containing beaker and boil for 5 minutes. The mixture was filtered by filter paper, ignite in tarred crucible at 450degree Celsius until all carbon has been removed, cool in desiccators and calculate water soluble ash of the crude drug with reference to the air-dried substances.

Water soluble ash value – (Z-X)100Y

Weigh of empty dish = (X)

Weigh of taken drug = (Y)

Weigh of dish + ash after complete incineration = (Z)

Acid soluble ash value –

The ash obtained from the total ash transferred in to 25 ml dilute hydrochloric acid containing beaker and boil for 5 minutes. The mixture was filtered by filter paper, wash the residue with hot water until it was free from

Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(1), 2607-2615 | ISSN:2251-6727

acid, ignite in tarred crucible at 450 degrees Celsius in a muffle furnace until it fee from carbon. The crucible was removed cool in desiccator and weighed. The percentage of acid insoluble ash was calculated with reference to the air-dried drug.

Acid soluble ash value – (Z-X)100Y

Weigh of empty dish= (X)

Weigh of taken drug =(Y)

Weigh of dish + ash after complete incineration= (Z)

Determination of moisture content –

Take flat and thin porcelain dish and weigh about 1.5 g of the powdered drug dry in the hot air oven at 105 C, until consecutive weighing do not differ by more than 0.5mg.cool and weigh .The loss of weight is recorded as moisture.

Loss on drying = (X-Z)100A

Drug taken = A

Weigh of drug with china dish = X

Weigh of dish after loss of moisture = Z

Determination of extractive value

Alcohol soluble extractive value-

A 4g accurately weighed coarsely drug powder with 100 ml of alcohol (90%) in stoppered conical flask for 24 hours, shaking frequently during first 6 hours and allowed to macerate for another 18 hours. Filter rapidly through filter paper taking precautions against excessive loss of solvents. Evaporate 25 ml of alcoholic of alcoholic extract to dryness and then the residue was dried to a constant weigh at 105 C.

Alcohol soluble extractive value = (X-Z) 100A

Drug taken = A

Weigh of 25 ml extract =China dish = X

Weigh of dish after evaporation = Z

Water soluble extractive value -

A 4g accurately weighed coarsely drug powder with 100 ml of chloroform water in stoppered conical flask for 24 hours, shaking frequently during first 6 hours and allowed to macerate for another 18 hours. Filter rapidly through filter paper taking precautions against excessive loss o water s. Evaporate 25 ml of aqueous extract to dryness and then the residue was dried ta a constant weigh at 105 C.

Water soluble extractive value = (X-Z) 100A

Drug taken = A

Weigh of 25 ml extract china dish = X

Weigh of dish after evaporation = Z

Microscopic evaluation

Microscopy

Microscopic evaluation of fresh leaves of moringa oleifera were performed. Anatomical sections section of the fresh leaves was prepared for microscopic evaluations to determine the trichomes, stomata, epidermis, palisade cells, parenchyma and vascular bundle.

Pharmacognostic evaluation of Moringa Oleifera

Determination of ash value

Weigh and ignite flat, thin porcelain dish or a tared silica crucible. Weigh about 2gm of the powered drug into the crucible. Support the dish on a pipe-clay triangle placed on a ring of retort stand. Heat with a burner using a flame about 2cm high and supporting the dish about 7cm above the flame, heat till vapors almost cease to be evolved, then lower the dish and heat more strongly until all the carbon is burnt off. cool in a desiccator, weigh the ash and calculate the percentage of total ash with reference to the air-dried sample of the drug.

Calculation

Weigh of the empty dish = x

Weigh of the drug taken = y

Weigh of the dish plus ash = z

Wt. of the ash = (z-x) g

Total ash value of the sample=100z-x\y

Determination of loss on drying

Weigh about 1.5g of the powdered drug into a weighed flat and thin porcelain dish, dry in oven at 100 degree centigrade or 105 degree centigrade until two consecutive weighing do not differ by more than 0.5 mg. cool in a desiccator and weigh the loss in weight is usually recorded as moisture.

Determination of extractive value

Weigh about 4g of the coarsely powdered drug in a bottle and transfer it to a dry 250ml conical flask. fill a100 ml graduated flask to the delivery mark with the solvent 90 percent alcohol. Wash out the weighing bottle and pour the weighing, together with the remainder of the solvent into the conical flask. Cork the flask and set aside for 24 hrs., shaking frequently. filter into a 50ml cylinder when sufficient filtrate has collected, transfer 25ml of the filtrate to a weighed thin porcelain dish as used for the ash values determinations. Evaporate to dryness on a water-bath and complete the drying in an oven at 105 degrees centigrade for 6 hrs. cool in a desiccator for 30 minute and weigh immediately. Calculate the percentage w\w of extractive with reference to the air-dried drug.

Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(1), 2607-2615 | ISSN:2251-6727

Phytochemical screening of Moringa Oleifera

Phytochemical constituent analysis of the leaf extract of Moringa oleifera was conducted to investigate the presence of alkaloids, flavonoids, steroid, and volatile oil, glycoside, reducing sugar, tannins and saponins was performed by the extracts. According to the procedure given by Talukdar AD 2010.

Alkaloid

Dragendroff test: to 2-3 ml filtrate add few drops dragendroff reagent. orange brown ppt is formed.

Mayer`s test: 2-3 ml filtrate with few drops Mayer's reagent gives ppt.

Flavonoids

Sulphuric acid test on addition of sulphuric acid flavones and flavono dissolve into it and give a deep yellow solution. flaves gives orange to red color.

Tests for carbohydrates

Molisch: to 2-3 ml aqueous extract, add few drops of alpha-naphthol solution in alcohol, shake and add conc. sulphuric acid from sides of the test tube. violet ring is formed at the junction of two liquids.

Fehlings test: mix 1ml fehlings A and 1ml fehlings B solutions, boil for one minute add equal volume of test solution. heat in boiling water bath for 5-10 min. first yellow then brick red ppt is observed.

Benedicts test: mix equal volume of benedicts reagent and test solution in test tube. heat in boiling water bath for 5 min solution appears green, yellow or red depending on amount of reducing sugar present in test solution.

Selwinoffs test: heat 3ml of selwinoffs reagent and 1ml test solution in bearing water bath for 1-2 min. red color is formed.

Determination of antimicrobial activity

The antibacterial activity of Moringa oleifera leaf extracts was determined using agar well Diffusion method. Nutrient agar was inoculated with Escherichia coli., Aspergillus niger and Bacillus cereus. Wells of 6mm were punched in the agar and filled with plant extracts. In the same plate control wells with distilled water were also run along with wells having plant extract. The plates were incubated at 37°C for 24 hours Bacillus cereus, 48 hours for Escherichia coli. and 96 hours for Aspergillus niger. The antimicrobial activity was assessed by measuring the diameter of the zone of inhibition.

1. Bacterial strains

On strains of gram positive (Bacillus cereus) and one strains of gram negative (Escherichia coli) bacteria. The bacterial strains were provided from the Microbial type culture collection and Gene Bank (MTCC) CSIR-Institute of Microbial Technology, Sector- 39A Chandigarh – 160036, India.

- Escherichia coli
- Bacillus cereus
- Aspergillus niger

These cultures were maintained on sterile nutrient agar slants and 4°C until further use.

Table :01(Different types of bacterial strains)

S. No.	NAME	MTCC NO	GENUS	SPECI.	INCU.TIME
1	Bacillus cereus	12856	Bacillus	Cereus	24hrs
2	Escherichia coli	42	Escherichia	Coli	48hrs
3	Aspergillus niger	11098	Aspergillus	Niger	96hrs

Result and Discussions

Physicochemical Parameters

In the physical evaluation,the loss on drying of powdered drug was 8.44 ± 0.1%, as the volatile components are not reported in the leaves; such higher moisture content can be the cause of deterioration by fungal or bacterial growth. The total ashvalue as 11.22 ± 0.3%, water soluble ash as 3.15 ± 0.1% and acid soluble ash as 0.30 ± 0.3% which explains about higher percentage of inorganic constituents present in it. The extractive values, as a firsthand representative of nature of phytoconstituents especially about its solubility in the specific solvents, were found to be- alcohol soluble (15.33 ± 1.5%) and water soluble (36.67 ± 1.8%). The foaming index of *M. oleifera*leaves extract was found to be 0.5 ±1 which give idea about the presence of percentage saponins in it, somewhat quantitatively, besides preliminary phytochemical screening.The range as well as average of different parameters are as follows:

Table 01 physicochemical parameters

S. NO.	Evaluation parameters	Percentage (%)

Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(1), 2607-2615 | ISSN:2251-6727

1	Moisture content	8.44
2	Water soluble extractive value	36.67
3	Alcohol soluble extractive value	15.33
4	Total ash value	11.22
5	Water soluble ash value	3.15
6	Acid Insoluble ash value	0.3

Preliminary phytochemical screening

On phytochemical investigation of various extracts; carbohydrates,proteins,tannins,flavanoids,alkaloids,glycosides were found present in Methanol extact.alkaloids and carbohydrate were reported in all extract.saponins present in all extract except methanol.stereoids present in all extract except aquous extract.

+ represents "present" and – represents "absent"

Table 02- phytochemical screening of Moringa oleifera.

Determination of antimicrobial activity

Test	Methanol extract	Water extract	Petroleum ether
Alkaloids	+	+	+
Tannins	+	+	+
Saponin	-	+	+
Steroids	+	-	+
Volatile oils	-	-	-
Glycosides	+	-	-
Flavonoids	+	-	+
Carbohydrates	+	+	+
Protein	+	-	-
Phenolic compounds	-	+	+

The antibacterial activity of Moringa oleifera leaf extracts was determined using agar well Diffusion method. Nutrient agar was inoculated with Escherichia coli., Aspergillus niger and Bacillus cereus. Wells of 6mm were punched in the agar and filled with plant extracts. In the same plate control wells with distilled water were also run along with wells having plant extract. The plates were incubated at 37°C for 24 hours Bacillus cereus, 48 hours for Escherichia coli. and 96 hours for Aspergillus niger. The antimicrobial activity was assessed by measuring the diameter of the zone of inhibition.

1. Bacterial strains

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- Escherichia coli
- Bacillus cereus
- Aspergillus niger

These cultures were maintained on sterile nutrient agar slants and 4°C until further use.

Microorganisms -

1. Inoculums preparation

The Bacteria were cultured on (2.8gm in 100 ml slants) for 24 hours up to growth of bacteria at

35°C the bacterial growth was harvested using 5 ml of sterile water.

2. Preliminary Analysis by Agar well diffusion method

The antimicrobial study method is used to evaluate antimicrobial activity of each plant extract. The plant extract residue 3gm in 60ml (60mg/ml) re - dissolve in water and sterilized by autoclave. In this method nutrient agar was poured in to a sterile Petridish and allowed to solidify. Now the bacterial suspensions were inoculated on to the above agar plates using a sterile glass loop. Mark the agar plate and required four wells were filed with the extract's petroleum ether, methanol,water extract by agar pour method. The plates were kept a side to permit plant extract diffusion then incubated at 37°C for different incubation period according table:01 The result was recorded as growth or no growth. The results are shown in table: 05

3. Determination of Minimum Inhibitory Concentration (MIC)

MIC means the lowest concentration of the antibacterial agent which inhibits the microbial growth after 24 hours of incubation. Different concentrations of the effective plant extract (60mg/ml) and (50mg/ml) were prepared separately by dissolving 3 gm. extract in 50 ml water. The nutrient agar media was poured in to sterile petri dishes and seeded with bacterial suspensions of the pathogenic strains. The few drops of different concentrations of the effective plant extract were placed on the top of agar plates. The plates were kept a side for

Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(1), 2607-2615 | ISSN:2251-6727

some times. Then incubated at 37°C for incubated duration according table 04. The inhibition zones were appearing in against the concentrations of the effective plant extracts.

3.1 Plant extraction yield

The inhibition zone assay revealed primarily two types of observations which were wells without any inhibitory zones which could be attributed to the absence of any inhibitory activity on the specific solvent of plant extract and clear inhibition zone representing the bacteriostatic and bactericidal effects of the tested plant extract. The highest yield of plant extract was taken 3 gm. of crude drug.

3.2 Antibacterial activity and antifungal activity of plant extract by well diffusion method

The four different solvents extract (petroleum ether, methanol, water) were investigated to evaluate their antibacterial activity against food poisoning bacteria including types strains gram positive aerobic bacteria (Bacillus cereus), gram negative aerobic bacteria (Escherichia coli) and fungus (Aspergillus niger) by using well diffusion methods. Evaluation of antibacterial activity of this plant extracts was recorded in table in table :05 and Figure: 01, this antibacterial evaluation study revealed that methanol extract has strong antibacterial activity against gram positive aerobic bacteria (Bacillus cereus) and gram negative(E.coli) as compared to other extracts and all extracts showed negative result for fungal species Aspergillus niger. According to this study suggested that presence of alkaloids, tannins and phenolic compound could be responsible for their antibacterial activity.

Minimum inhibitory concentration of the effective plants extract

The minimum inhibitory concentration of the most effective plant extracts (methanol) was employed by well diffusion method to evaluate their antibacterial properties the concentration effect of the effective plant extracts was reported in table:05 and figure:01 . The inhibitory effect of methanol extract started at 60 mg/ml. with inhibition zones of 0.3mm against Bacillus cereus and E.coli while no inhibition zones appear at petroleum ether and water extract at 50mg/ml concentration.

Source of microorganisms

The organisms used were Bacillus cereus, Escherichia Coli. and Aspergillus niger.

Antimicrobial assay and MIC

Table-05 ANTIMICROBIAL ASSAY & MIC

Extracts		Minimum Inhibitory Concentration (MIC)	
	Bacillus cereus	*E.coli*	*Aspergillus niger HN-2*
Petroleum ether	> 100 mg/ml	> 100 mg/ml	> 100 mg/ml
Aqueous	> 100 mg/ml	> 100 mg/ml	> 100 mg/ml
Methanol	60 mg/ml	> 100 mg/ml	> 100 mg/ml

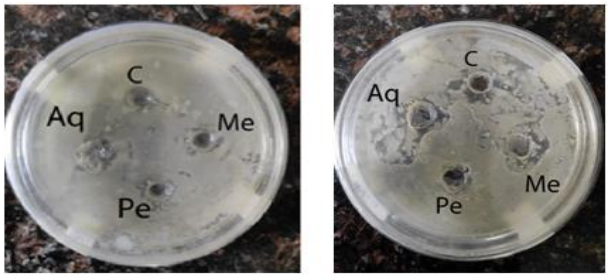
Overall the results of the presents study showed the some Moringa oleifera extracts are effective at preventing the growth of food borne pathogenic and spoilage microorganism.

In vitro study

Antimicrobial study

The significance of some extracts against the tested food-borne pathogenic and spoilage bacteria and fungi was revealed by the antimicrobial assay. The petroleum ether and acetone extracts clearly inhibit the growth of at least one microbial strain, according to the antimicrobial assay.

Further, methanol extract of *Moringa oleifera* showed inhibition of *Bacillus cereus* (diameter of inhibition zone – 30 mm) with MIC value of 60mg/ml while showed no growth inhibition of *Aspergillus niger* HN-2 and *E.coli* up to 100 mg/ml. Similarly, Petrolum ether and aqueous extract ineffective against *Bacillus cereus,E.coli* and *Aspergillus niger* HN-2 up to 100 mg/ml. petroleum ether and aqueous extracts were found to show no particular inhibition to all two tested microorganisms up to the concentration of 100 mg/ml.



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Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(1), 2607-2615 | ISSN:2251-6727

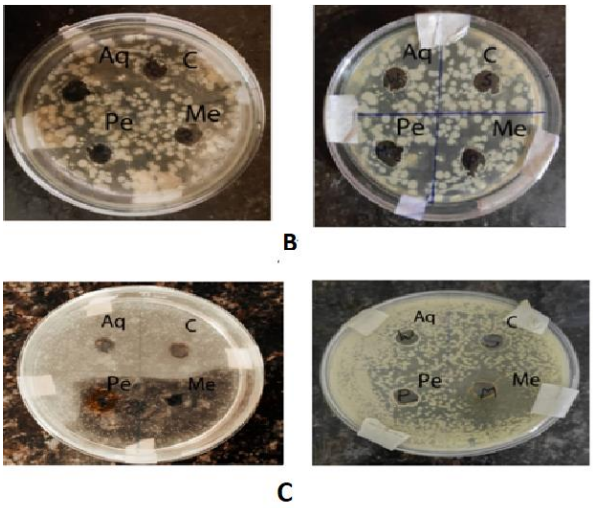

Figure No. 01:Antimicrobial assay against(A)-*E.coli*(B) -*Bacillus cereus*, (C)- *Aspergillus niger* HN-2, Aq- Aqueous extract, Me- Methanol extract, Pe- Petroleum ether extract and C- Control

CONCLUSION

Moringa oleifera is an important medicinal plant one of the most widely cultivated species of the family Moringaceae. Pharmacologically reported that different parts of it have been used for different human ailments, extracts showed varying degrees of antimicrobial activity on the microorganism tested.

The study revealed that Moringa oleifera plant shows the presence of phytochemical constituents like alkaloids present in methanol, petroleum ether and water extract, flavonoid present in methanol and petroleum ether extract, volatile oil present in methanol,petroleum ether and water extract and carbohydrates present in all extract,phenolic compound present in methanol,water and petroleum ether extracts.

Antibacterial activity of Moringa oleifera was seen against several bacteria namely Escherichia Coli, aspergillus niger, and bacillus cereus. The methanol leaf extract of Moringa oleifera show the minimum inhibitory concentration(60mg/ml) against Bacillus cereus and E.coli.

Conflict of interest: None

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