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A REVIEW ARTICLE ON THE PLANT- MENTHA ARVENSIS

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ABSTRACT

The use of the herbal drug, Mentha Arvensis belonging to the family Lamiaceae possesses antimicrobial activity, antioxidant, antifungal, cytotoxic activity and other pharmacological activities. Other than medicinal use it is also widely used in food and beverages. Steam distillation for the process of extraction and fractional distillation for the method of isolation, along with the mechanism of action for antimicrobial activity is discussed. Tests for antimicrobial activity are agar well diffusion method, disc diffusion method, minimum inhibitory concentration (MIC) were reviewed in different concentrations. This review article gives a more detailed account of the whole plant so that more activities can be done on this plant which are often use in our daily life.

KEYWORDS:- Extraction, Isolation, Antimicrobial activity, Antioxidant, Antifungal, Cytotoxic activity.

Figure 1: Mentha arvensis.

INTRODUCTION

The synonym is of Mentha Arvensis is corn mint, field mint, wild mint. The common name of the plant is Mint, and it belongs to the Family – Lamiaceae. It is used as a vital source of antimicrobial compound. Several medicinal plants are utilized all over the world for the treatment of various illnesses. Treating people using herbal drugs is considered the safest method with radio property effects. Mentha Arvensis which is a herbal drug is used diversely. Most importantly it has been used as a counteragent for poison. It is also used in Indian spices as food seasonar and salad dressing in every household throughout the world since a very old time. The juice of these leaves is used when a person is suffering from diarrhea, dysentery and is also given during jaundice, asthma, indigestion, arthritis, and who have inflamed joints. It is used to treat many skin infections, sensitive skin, burns, headaches, and itching. Menthol one of its important constituents is obtained from its essential oil which is used in the pharmaceutical, cosmetic, tobacco, and Food industries. The proportion of menthol present is 40 to 50% that acts as an ACS – antiseptic, carminative, and a stimulant. Mint is a common herb that is inexpensive and easily available in a large amount. The plant has a long life span with a powerful, mint, fresh, cool, and distinctive odor.

Morphological description[6]

Month: - February and March.

Stem: - Dark green in color, quadrangular in shape, tall in size, and it holds the opposite leaves at every node.

Figure 2: Mentha arvensis stem part.

Internode region:- It smooth and striated.

Leaf base:- The stipules are absent, petiole which is the stalk that attaches the leaf to the plant stem is of size 0.8 cm to 1.8 cm in length and 0.9 to 1.8 mm in breadth.

Lamina surface:- This exhibits hair that is 5-celled, it is unbranched and moderately thick-walled. The lamina composition is simple, the leaf blade that has cuts that go up to the midrib is not seen here, it is elliptical, shows reticulate venation (veins arranged in either web-like or network like all over the lamina), possess serrate margin, acute apex, lamina base symmetrical with tapering base, surface hirsute, green in color, coriaceous texture, the length of the lamina is variable ranging from 3-7 cm while the breadth ranges between 1 to 2.5 cm.

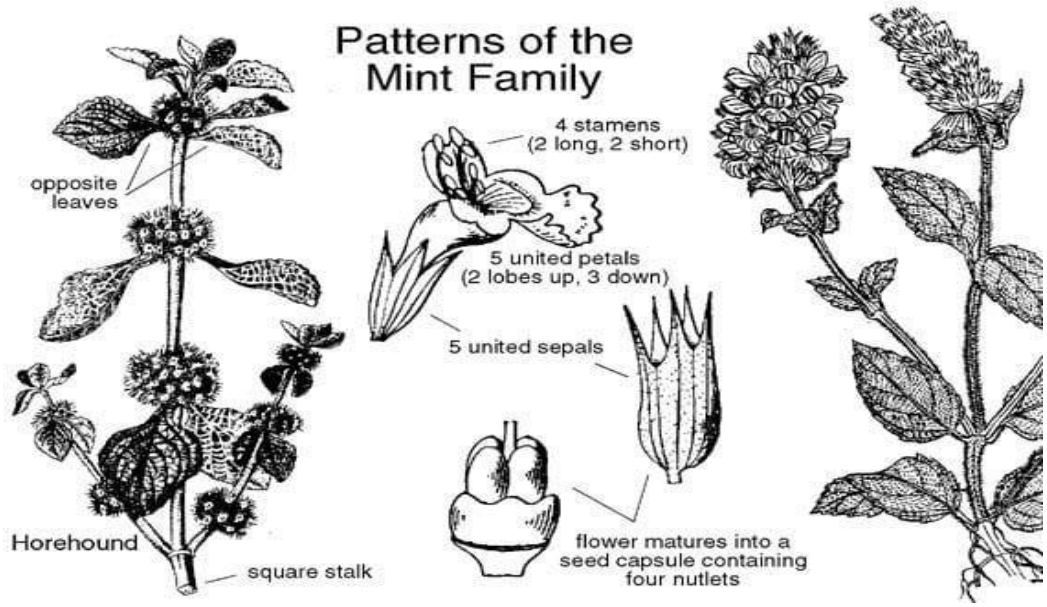

Figure 3: The pattern of the mint family.

Microscopic description[6]

Transverse section (T.S.): - The stem exhibits a quadrangular smooth outline. The epidermis is covered in a single layer of cuticle. Underneath the epidermis, a bunch of annular collenchymatous cells is present which is in each of the four angles of the stem. The cortex is parenchymatous. The outer cortical cells have chloroplast. The vascular tissue is collected in a group of four which is opposite to the four corners that slowly reduce towards the sides. The center consists mainly of parenchyma cells.

T.S. of midrib:- It shows protruded midrib towards the lower surface and encloses a crescent-shaped vascular bundle. Lamina is dorsiventral, the epidermal cells of both surfaces

are wavy, stomata are diacytic (cross celled), uniseriate with pointed apex. Palisade the ratio is 6 to 8, vein islet number 18 to 20, the stomatal index for upper epidermis 10 to 20, Lower epidermis 15 to 30.

Distribution[5,11]

Mentha Arvensis is native to the temperate regions of central and western Asia and Europe is cultivated in tropical regions of Asia and has been established in North America. Mentha arvensis grows naturally and has existed for many years throughout North America. It is found in all states of the United States. It is largely cultivated in damp soil.

Active constituents[2,11]

It consists of terpenes such as α-menthol, neomenthol, isomenthol, d-menthone, isomenthone, menthofuran, menthylacetate, carvomenthone, cineol, p-cymene, aromadendrene, limonine, -phellandrene, pipertone, -pinene, carvacrol, α-pinene, α-phellandrene, -pinene, dipentene, cardinene, and -thujone depending on the type season, on the climate and the plant processing in different amounts. It also contains the flavonoids such as quercetin, menthoside, and isorhoifolin, vitamin K, thymol and eugenol.

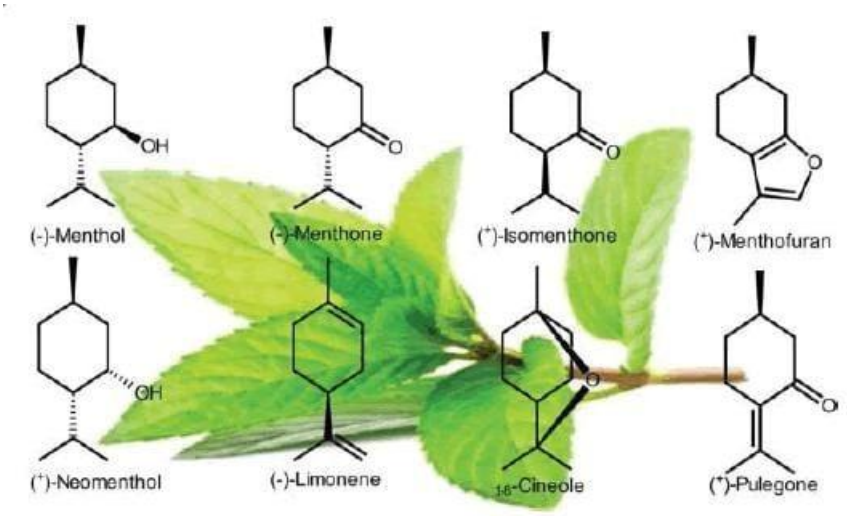

Figure 4: Active constituents of mentha arvensis.

MATERIALS AND METHODS[2]

The plant samples are collected from the botanical garden, the collection is thoroughly washed, dried, and crushed by hands. The dried material is crushed in the mixer grinder to form a coarse powder. Then, it is stored in airtight containers at 28 degrees C for the extraction process.

The method of extraction[7]

There are several procedures used to withdraw the essential oils from plant materials, for instance- hydro distillation, steam distillation, solvent-free microwave extraction and supercritical fluid extraction. Selection of method is crucial as that method would choose which would give high content of Menthol. One of the technique is described below:-

Steam distillation[7]

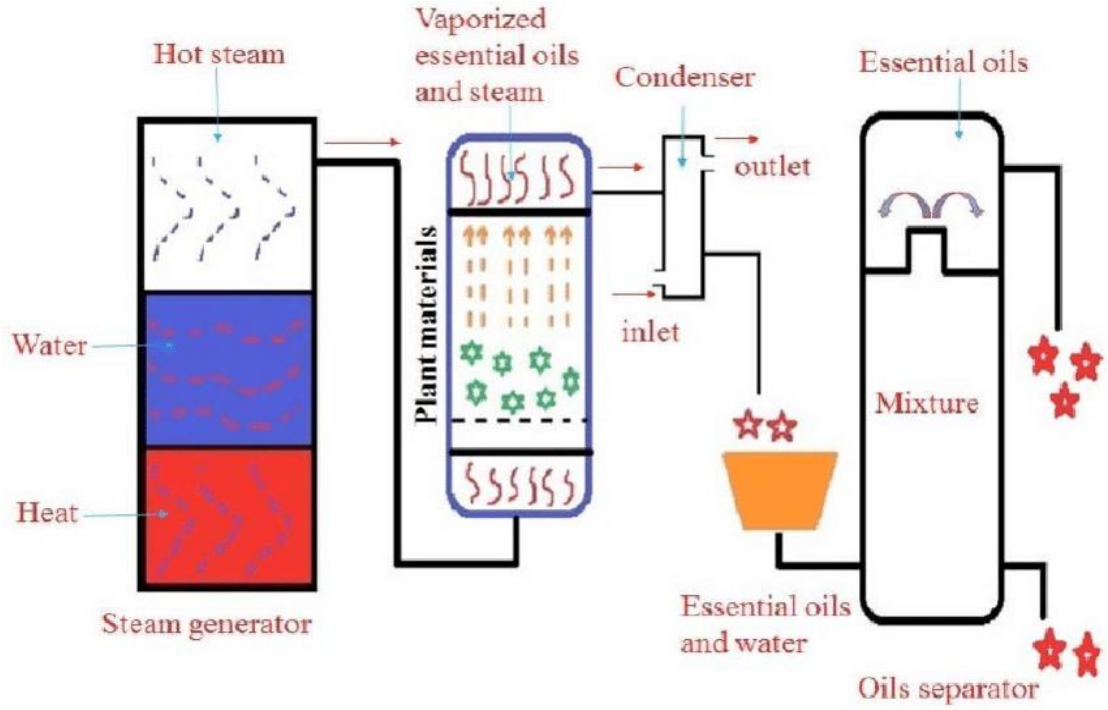

Figure 5: Steam distillation.

Steam distillation is one of the extensive practices that is used for extraction of the essential oils from their sources, due to its profitable worth, it is an extremely promoted method. This distillation method is to be produced at a low temperature. It makes the attainable dissociation of non-volatile substances and the material that are immiscible in the water beneath the boiling points of every separate constituent. This method of steam distillation is used to withdraw mint oil. The conventional steam distillation in 2-L steam distillation is used to extract the essential oils of Mentha Arvensis. When the initial drip of essential oil gets settled in the Florentine (a separator vessel), the distillation is measured. The mint oil is collected straight at the end of every distillation after switching off the current. By using the analytical standard balance, the specimen of corn mint oils are measured, the content of oil (the yield) is calculated as grams of oil per 100 g of dried Japanese corn that mint shoots. The term content is normally used to show the amount of essential oil in biomass of 100 g.

The elements are independently present in mint oil as a percentage of the total oil. The complete production of different constituents is calculated from the yield of the essential oil and the concentration of every component in the oil. The yield of menthol is shown 74 to 79% and the temperature for this extraction is 35 to 40 ºC.

Methods of isolation of menthol[7]

The methods used to isolate menthol from the extracted essential oil of mint are:-

- Fractional distillation
- Chromatographic adsorption methods

Fractional distillation[7]

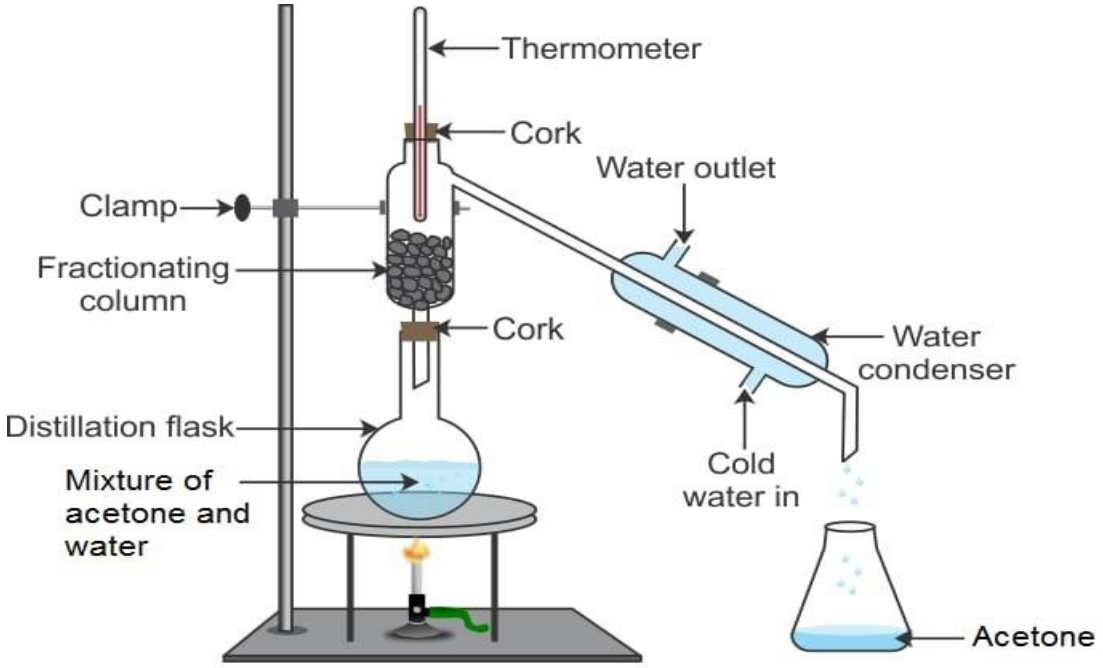

Figure 6: Fractional distillation.

Generally 60% to 85% menthol with 12% to 20% menthone exists in Mentha Arvensis essential oil, however, there is a disadvantage of the presence of these two compounds simultaneously, as they match to a definite limit in their physical features, hence the isolation of menthol from the essential oil of mentha becomes tough. Fractional distillation is a good and advantageous operating procedure for the isolation of menthol from the essential oils of mentha.

In a research, Fractionation was carried out below the force of 50mm Hg for the distilling off the Xenthone and bottommost boiling components following this steam distillation operation.

The disconnection of menthol from non-volatile residue is left behind. The purification of menthol progresses, preferably by soaking in boiling water and getting soften by this.

It is repeated numerous times until the melting point of product is extended at desired U. S. P standard. Instead of the minor difference in the boiling points of the two components under atmospheric pressure, when pressure is turned down from atmospheric pressure it was observed that these slight differences in boiling points and the relative volatility is intensified.

Hence, fractional distillation proceeds the separation of menthol and menthone from mint oil and menthol is manufactured from mint oil. Despite fractional distillation is usually utilized in investigating the synthesis of essential oils, it is unused for forming menthol from mint oils on a business scale. Hence slight strict demands on the exact fractionation can be encountered by the following steps: -

1) By conducting vacuum distillation in a column, menthone and other fractions are distilled off.
2) Isolation of menthol from non-Volatile compounds by steam distillation, and
3) Menthol purification by the action of digestion in water, formation of crystals, and drying.

Fractional distillation of mint oil was performed in a Batch Column, which comprised of

a) 50 theoretical plates and having a ratio of about 50 at a pressure of 20mm.
b) This fractionally distilled mint oil contained 65.2% menthol, 12.5% menthone, and 1.8% menthyl esters.

After that, distillation was ceased, and the product obtained was known as menthone-free-oil. This solidified at normal temperature and weighed just about 70% of the total charge. It comprised of about 89% menthol and 6.5% unstable components. After this, under the atmospheric pressure, steam distillation of menthone free oil was concluded until all the unsteady components disappeared. The condensate isolated into two layers and on cooling, the menthol coating gets solidified to a crystalline mass. After the drying process, the melting point of menthol was 29 ºC to 35 ºC which was still not reached to the U.S. P. standard. The yield of this unpurified menthol was about 88% of the menthone-free-oil. This untreated menthol was cleaned by absorption with water to remove the polluting influences. 100 ml of water was heated up with about 10 grams of crude menthol in a flask for about 10 minutes. Constant shaking and stirring were essential to keep the oily menthol layer in particular contact with the water layer. The menthol layer was solidified after cooling, after which it

was isolated from the solution. It was melted between 38° C to 40.5 °C on drying. The process of digestion utilizing another 100ml of water was repeated once again. The improvement in the melting point of the product was within U.S.P specifications, from 41.6 °C to 42.7 °C.

Observations[7]

- Long needle-like crystals of the pure product acquired about 9.5g. Almost 92% USP standard menthol was obtained from crude menthol.
- A small dropping of menthol with impurities in the solution of water at room temperature was observed.
- The solubility of menthol was just 0.42 g/litre of solution.
- Separation of about 85% of the total menthol comprised in the mint oil.

Phytochemicals present in mint[8]

Despite any species of the plant, the phytochemical present in several species of Mentha are identical but the ratio may differ. Around 40 distinct chemical compounds are present in mint. The essential oil of peppermint is largely made up of menthol, menthone, Menthol esters, 3-carene, carvone, cis-carane, cispinane, isomenthone, limonene, menthanol, Myrcene, and also pulegone, piperitone, menthofuran, trans-cinnamic Acid, oleanolic acid, p-cymene, physcion, terpinolene, and urosolic acid which are the monoterpene derivatives. Other compounds are α-pinene, β-pinene, cineole, jasmone, ledol, limonene, neomenthol, piperitone, Pulegone, and viridiflorol are also present. Menthol and menthol acetate are in charge for the strong and refreshing odor whereas the ketones menthone, pulegon, menthofuran have a very pleasant fragrance. Traces of jasmone enhance the oil's quality. The mint Plants also contain the flavonoids acacetin, chrysoeriol, diosmin, eriocitrin, hesperidin, hesperidoside, isorhoifolin, linarin, luteolin, menthoside, methyl Rosmarinate, rutin, tilianine, narirutin, and nodifloretin. Caffeic Acid, lithospermic acid, rosmarinic acid, protocatechuic acid, protocatechuic aldehyde, Phytosterols, β-sitosterol, and daucosterol are the phenolic acids present and the other compounds that are present are the anthraquinones aloe-emodin, chrysophanol, Emodin, and tannins

Mechanism of action[8,13]

The aqueous extracts of varied species of Mentha showed anti-oxidative properties. It had been observed that the M. x Piperita"Frantsila" extract was better than the other extracts and

this activity was strongly related to the phenolic content. The whole antioxidant activity was highest in ester and aqueous and minimum in hexane and chloroform fractions. The association with qualitative analysis depicted the antioxidant effects were addicted to the phenolic content within the fractions. The ester, acetonitrile, and aqueous soluble extracts of M. Piperita leaves were also observed to look 1, 1'diphenyl-2-picrylhydrayl, 2,2'-azinobis(3-ethylbenzothiazoline-6-sulfonate) (DPPH), and hydroxyl radical scavenging assays, whereas the aqueous and dichloromethane-soluble extracts were productive within the β-carotene-linoleic acid bleaching inhibition assay. The essential oils from M. Aquatica, M. longifolia, and M. Piperita also possessed free radical scavenging effects, and also the oil of M. Piperita was effective in both DPPH and OH radical scavenging assays. The aqueous and chloroform extract of M. arvensis were potent scavengers of nitric oxide invitro. The polyphenolic compounds that were isolated from the aqueous extract of peppermint leaves are eriocitrin, luteolin-7- O-rutinoside, diosmin, hesperidin, narirutin, Isorhoifolin, rosmarinic, and caffeic acids were studied for their antiradical activity in the DPPH assay. The study showed that luteolin-7- O-rutinoside, eriocitrin, androsmarinic acid possessed good activity, while caffeic acid, hesperidin, isorhoifolin, narirutin, and diosmin showed lesser activity. In the anti-hydrogen peroxide activity, positive activity was detected for eriocitrin, rosmarinic acid, luteolin-7-O-rutinoside, and caffeic acid, in the time hesperidin, diosmin, narirutin, and isorhoifolin were not successful.

Antimicrobial activity[12]

One of the severe concerns in medicinal science is the increase in the rate of infectious diseases worldwide. The agents that cause microbial infection are the microorganisms such as pathogenic bacterial and fungal strains. These microorganisms possess the power of surviving under harsh environmental conditions which can lead to the development of Multi Resistance Drugs (MDR) posing health threats. Currently there is an urge to develop plant-based novel and safe natural antimicrobial agents because of the reason that the synthetic drugs available in a restricted amount and are expensive to people while some exhibit the lowest or side effects. It was reported that ethanol extract of M. arvensis induced the generation of ROS in A.Baumannii cells in a dose-dependent manner, triggering cell membrane damage and protein leakage from the treated cells in a dose-dependent and time-dependent manner. The structural equation modeling (SEM) visualizations specifies that on increasing the extract concentration it may provoke considerable cellular damages and morphological changes, consistent with ROS generations and protein leakage. Based on their ethnomedicinal which is

based on bioactive compounds in plants and animals and traditional uses against infectious diseases based on literature survey and interaction the Mentha Arvensis plant is chosen for the antimicrobial assay. Mentha essential oils showed antibacterial activities against pathogenic bacteria including both gram-negative and gram-positive, such as Pseudomonas aureus, aureus, Bacillus subtilis, Escherichia coli, Pseudomonas aerogenosa was studied using disc diffusion assay. The antimicrobial activities of Mentha essential oils are allocated to volatile bioactives, for instance oxygenated monoterpenoids with monoterpene hydrocarbons (MHs) and sesquiterne hydrocarbons. The Mentha essential oils shows antibacterial activity opposite to pathogenic bacteria including both Gram- negative and Gram-positive, such as Pseudomonas aureus, Bacillus subtilis, Escherichia coli, Pseudomonas aerogenosa, Serratia marcesens, and Streptococcus aureus Saba . Mentha component activity against multiple strains of bacteria have a pronounced impact in the future production of novel plant-derived drugs and in food storage/protection. However, the antimicrobial effect needs to be better explained considering that it might be due to the occurrence of bioactives such as luteolin, rosmarinic acid, caffeic acid, gallocatechin, epigallocatechin gallate and catechins, menthone, isomenthone, and hexadecanoic acid in this species.

Preparation of crude extracts[2]

The leaves are shaded, dried, and powdered. This is then used for the extraction process. 100 gm of dry powder is taken in an aspirator bottle, 300mL 10% methanol (1: 3 W/V) is used and the mixture is shaken occasionally for 48 hours. The extract is filtered. The procedure gets repeated 3 times and all extracts are decanted and combined. The Extracts are filtered before drying using Whatman Filter paper no. 2 on a Buchner funnel. The solvent is removed by vacuum distillation in a rotary Evaporator at 40◦C for the quantitative determination. The extracts are placed in pre-weighed flasks before drying. The remaining plant residue is extracted with 50% methanol, ethyl acetate, and chloroform sequentially.

Antimicrobial susceptibility assay[2,3]

The following methods are used: -

Disc diffusion method[2]

By using the Disc-diffusion method the antimicrobial activity is carried out.

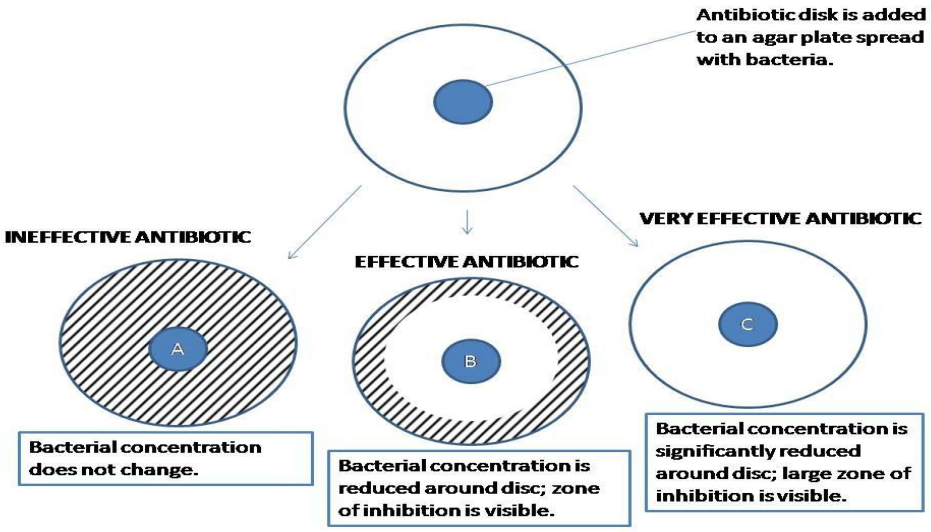

Figure 7: Disc diffusion method.

The process

Petri plates were prepared with 20mL of sterile brain heart infusion agar (BHI) for the test cultures. The suspension containing bacteria was scrubbed on the top of the solidified media and was allowed to dry for 10 minutes. The tests was conducted at three different concentrations of the crude extract. The sterile disc is soaked with different concentrations of extracts. The loaded discs are placed on the surface of the medium and left for 30min at room temperature for compound diffusion.Negative control is prepared by using respective solvent. Amoxicilline were used as positive control. The plates were incubated for 24 h at 37 degree C. The zone of inhibition is reported in millimeters and the experiment is repeated twice.

Agar well diffusion method[3]

The stock solution of the test material: - The residues that are obtained at 4 degrees C are dissolved in dimethyl sulfoxide (DMSO). This is kept at 28 degrees C till it gets used. In this assay, DMSO is taken as a control. The volume of the test solution was in the range of 10-15 µl. The wells are kept for 10 minutes and sealed with molten Muller Hinton agar (MHA). Further, these plates are washed with 0.5 Mc Farland and incubated overnight at 35 degrees C. The zone of inhibitions is recorded in the test well and also in the control well. The assay is repeated twice.

Minimum inhibitory concentration (MIC)[2]

MIC is considered as the less concentration of the extract that hinders the growth of the test organism. This experiment is carried out in triplicate.

We dissolve the extract in water +2% dimethyl sulfoxide (DMSO). The initial concentration of extract is found to be 5 mg/ml. The initial test concentration is serially diluted two-fold. Each well is inoculated with 5 µL of suspension which contains 108 CFU/mL of bacteria. The Antibacterial agent Amoxicilline is incorporated in this assay as a positive control, followed by incubation of 24 hours at 37◦C. Subsequently after incubation, 5 µL of tested broth is put on the sterile BHI plates (Brain Heart Infusion Agar) and incubated at respective temperature. The MIC for bacteria is determined as the least concentration of the extracts by obstructing the visual growth of the test cultures on the agar plate.

Antioxidant activity[12]

The utilization of plant-based extracts has increased nowadays due to natural oxidants present in them which possess medicinal benefits and are safe to use when compared with synthetic formulations. The essential oils extracted from these medicinal herb act as an effective antioxidant agent which reacts opposite to the free radicals. A wide span of in vitro antioxidant assays such as (2,2-diphenyl-1-picrylhydrazyl) (DPPH) radical scavenging 2,2'-azino-bis (3-ethylbenzothiazoline-6-sulfonic acid) (ABTS+) inhibition of linoleic acid Peroxidation and reducing power assays The researchers have been successfully working by examining the antioxidant effects of Mentha plants. Phenolic compounds, ascorbic acid, and carotenoids along with several medicinal plants such as the Mentha genus exhibits high levels of antioxidants that help delay or inhibit the oxidation of individual molecules. For instance, phenolic compounds act as free radical scavengers and inhibit Lipid peroxidation During various studies carried out on the antioxidant ability of Mentha species, it was reported that among nine Mentha species M. longifolia was the most effective one, showing an 88.6% antioxidant activity compared to the 93.0% activity of ascorbic acid at a concentration of 100 µL/mL, whereas M. suaveolens 'Variegata' (pineapple mint) had no antioxidant activity. There can be numerous factors for varying results such as the cultivation methods vs wild harvest of plants, type of laboratory investigations or extraction methods, etc. It has been reported that cineole, an important constituent of Mint extract, mitigated the ethanol-induced gastric mucosal damage in rats due to antioxidant property. Nevertheless, we know that in the extraction method, the solvent used and the extracted fractions analyzed show a direct effect on the composition and ratio of compounds, the result of various studies showed that Mentha species, given their significant antioxidant activities. Hence, we can positively use it in pharmaceuticals, food, and cosmetic industries when Antioxidant effects are sequential.

Antifungal activity[10]

The unhealthful infective fungi are the pathogens that lead to economic destruction in two ways, firstly it can cause a direct effect in the agricultural production system, and secondly an indirect result in the ecological problems, because of the use of pesticides for its control. Synthetic fungicides are used to control the disease which in turn give rise to several adverse effects which are the evolution of resistance in the pathogen, residual toxicity, environmental deterioration, expenses, etc. Thus, the need has risen to take on an environmentally friendly outlook for better health of the crop and the yields. The purpose of this work is to check the production and quality of essential oils removed by the process of hydro distillation of leaves, to examine the anti-fungal capability of menthol mint essential oil together with the isolated substances of this oil that are menthol and menthone, on the fungi Fusarium moniliforme and Rhizoctonia solani, discovering for substitution to synthetic fungicides in dealing with commercial seeds. Essential oil, menthol, and menthone are analyzed for their antifungal activity.

Procedure:- Two fungi for bioassay are chosen, which are Fusarium moniliforme and R. solani. A culture of the test fungi is grown on a potato dextrose agar (PDA) medium for usually 7 days at room temperature (25 ± 1 C) for growth. Stock solution (1000 lg/ml) of test compounds Is prepared in Dimethyl sulphoxide (DMSO) and further dilutions Are Done (500, 250, 100, and 50 lg/ml) and stored at 4 C for further use. Potato Dextrose Agar media, containing a Specific concentration of the test compound was poured on To the Petri plates. After solidification, a small disc (0.5 cm Dia.) of the fungus culture was cut with a sterile cork borer And transferred aseptically upside down in the center of the Petri plate. Petri plates were incubated in a BOD incubator at 25 ± 1 degree C. The fungal growth is measured after every 24 hours until the fungus in the control plates along with Dimethyl sulfoxide is entirely occupied it. For every treatment 3 replications were maintained. The % growth inhibition over control was calculated as I = 100(C-T) / C, where I = inhibition percentage, C = growth in control. Saccharomyces cerevisiae at times is used as a model organism to examine the activity of anti-yeast and to study the mode of actions of different compounds.

To determine the cytotoxic activity by brine shrimp lethality bioassay[9]

Brine shrimp lethality bioassay is a cytotoxicity test of bioactive chemicals. It is based on the killing capability of test compounds on brine shrimp. To detect cytotoxicity activity, In vitro lethality bioassay of the ethanolic extract of M. Arvensis L. was utilized.

Procedure

Sea salt of 38 g is weighed precisely and dissolved in distilled water to make 1litre, then it is filtered to get a clear solution. Seawater is taken in a small tank and brine shrimp eggs are added followed by incubation at 28 °C in front of a lamp. The shrimps are allowed for 24 h to hatch and mature as larvae. A solution of 5 µg/µL of the extract is prepared by using dimethyl sulfoxide (DMSO). Thus, for these 24 clean test tubes are taken, where the 12 test tubes were taken for the samples in six concentrations (2 test tubes for each concentration) and 12 for the control test. To each of the test tubes 5ml of seawater was given. With the help of the micropipette, specific volumes of samples are transferred from the stock solutions to the test tubes to get final sample concentrations. The concentration of DMSO in these test tubes did not exceed 10 µL/mL. For control, the volumes of DMSO which were in the sample test tubes are taken in another 12 test tubes. Finally, by using Pasteur pipette 10 living shrimps are kept to each of the test tubes. After 24 h the test tubes are observed and the number of survived larvae in each test tube are counted, and the results are noted. From this, the percentage of the lethality of brine shrimp larvae was calculated at each concentration for each sample. Then percent mortality is plotted against log concentration on the graph paper to produce an approximately linear correlation between them graphically.

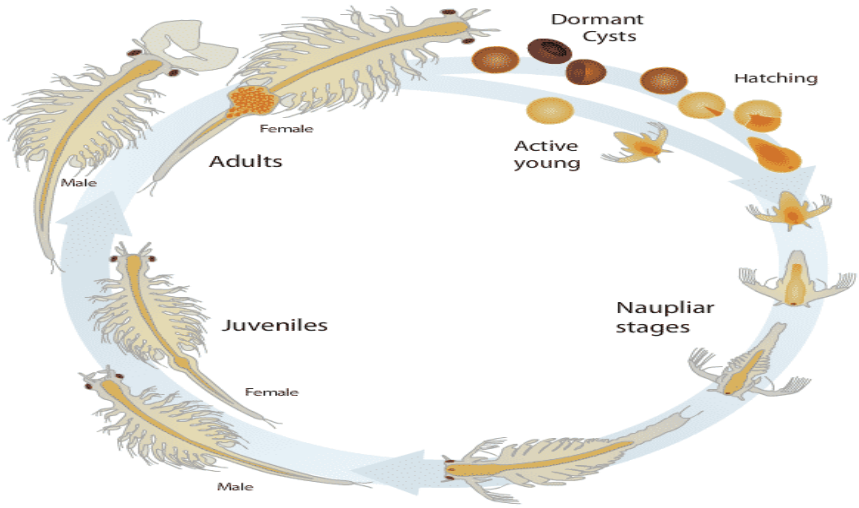

Figure 9: Cytotoxic effects.

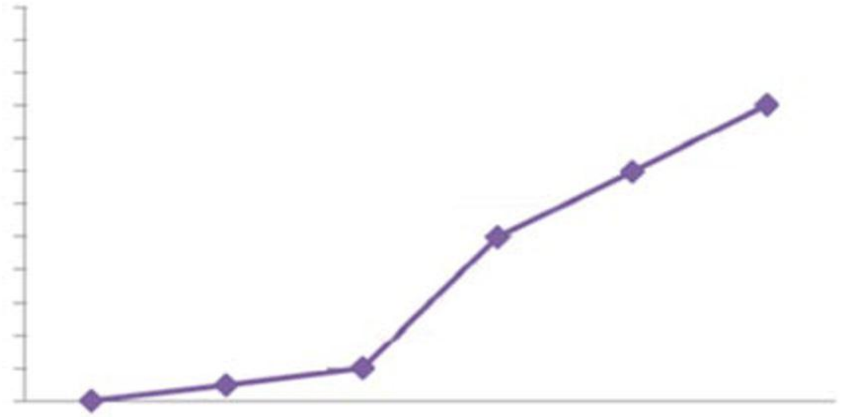

Figure 8: Brine shrimp of ethanolic extracts of mentha arvensis L.

Applications of Mint[8,5]

1) The fresh leaves of pudina are found to contain moisture, proteins, carbohydrates, calcium, iron and volatile oils.
2) The active constituent present in mint which is menthol provides a cooling sensation.
3) Mint is used in treatment of nausea, vomiting, indigestion, bad mouth smell, inflamed joints, the juice of this leaf is taken during diarrhoea.
4) ACS- antiseptic, carminative, and a stimulant.
5) Pudina helps in the healing of skin rash, itchy skin occurred due to food allergies.
6) The extensive use of pudina is as a flavouring agent in culinary preparations.
7) Due to its anti-bacterial property, it is used in swollen gums, mouthwashes, and tooth pain.
8) Pudina is utilized in various pharmaceutical products, it is used in cosmetics by providing fragrance in soaps, perfumes, and toothpastes.
9) Menthol is used in production of cold balms, lozenges. Pain balm, Dabur Pudin Hara, in ointments such as Vicks Vaporub. [14]
10) It has vasodilating property used as a rubefacient [14]

CONCLUSION

In today's time, every individual tends to remain fit and active. With the expanding health consciousness, day by day and by increasing the side effects of conventional medicines the trend is shifting towards a non-conventional system of medicines. In recent times the growing interest of individuals is seen towards herbal drugs. Mentha Arvensis is a very important drug due to its several functions in medicine, pharmaceutical, cosmetics as well as in the food

industry. Apart from treating antimicrobial diseases, it is also used as an anti-inflammatory, antioxidants, in cancer, it shows radioprotective activity. Pudina is also famous for indigestion, nausea, vomiting, food allergies, for the bad odor of the mouth. Apart from applications in clinics, mint can be used as a radiation countermeasure in the management of nuclear incidents. Due to inexpensive and easily available the possibility of investigating more deeply increases.

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