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Full Length Research Article

Comparative Analysis on Antimicrobial Activities of different Parts of *Zea mays* Plant

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Abstract

Indian corn, corn, maize are other names for *Zea mays* plant. In the current study, an effort was made to check into *Zea mays* antimicrobial characteristics. The aforementioned plant's leaves, silk and root were collected for the study and turned into a basic medication powder extract. The gram-negative bacterium *Pseudomonas aeruginosa* was utilized to carry out the antibacterial activities. The *Penicillium expansum* was utilized to carry out the antifungal activities. The disc diffusion method was utilized to test antibacterial activity. Test material extracts in ethanol solvent exhibited strong antibacterial activity against harmful microorganisms. The data revealed that *Zea mays leaves* ethanol extract displays maximum antibacterial activity and maize silk extract revealed maximum zone of inhibition against reference compound.

***Key words*:** Antibacterial, Antifungal properties, Plant extracts, *Penicillium expansum*, *Pseudomonas aeruginosa*

Maize silk is the term for the corn female flower's projecting stigma. *Zea mays* carries the stigma. It is abundantly available everywhere and is a waste byproduct of maize farming. In China, corn silk was used to treat cystitis, jaundice, edoema, prostate diseases, urinary infections, hyperglycemia, and obesity. It was also noted to have diuretic and detumescent properties as well as positive effects on the liver and gallbladder [1]. Modern research has documented the bioactivities of maize silk, including its antioxidant and anti-diabetes properties [2-3], anti-obesity properties [4], neuroprotective and antidepressant effects [5-6], anti-cancer properties [7], and anti-nephrotoxicity properties [8], among others. Chemical analysis of maize silk indicated the presence of volatile oils, steroids, saponins, polysaccharides, alkaloids, flavonoids, organic acids, and other phenolic substances [9]. *Zea mays* has been utilized for a long time as a traditional herbal remedy to treat hyperglycemia, however there are relatively few systematic studies on its effectiveness in treating diabetes and its related problems. Therefore, the goal of this experiment is to determine how well corn silk, root, and leaves function as an antibacterial. Targeting maize silk as a natural antioxidant source will also encourage the responsible use and development of this unwanted agricultural residue.

The waste byproduct of maize is known as corn silk (corn). A vital cereal and edible grain, maize is the third most widely grown food crop in the world and one of the main sources of energy. Along with proteins, vitamins, and carbs, corn silk is a great source of fixed and volatile oils, steroids like stigmasterol and sitosterol, alkaloids, saponins, and other naturally occurring antioxidants including flavonoids. Corn produces solitary blossoms. Tassels are the male flowers that generate yellow pollen. Produced by the female flowers is corn silk. The silks serve as the stigma of the female flower, and as the fruit grows, they extend past the cob to cover the plant's edible portion. Corn silk starts out as a bright green colour before changing to red, yellow, or light brown over time. One corn kernel can be produced from each pollinated silk of the plant. Additionally, it contains fibres that are crucial for diet, maizeric acid, resin, sugar, and mucilage [10]. It also has ingredients that have diuretic (water pill-like) effects, can affect blood sugar levels, and is useful for lowering inflammation. The use of corn silk dates back a long time. Historically, urinary tract issues, pathological edoema, asthma, dropsy, and hypertension have all been treated with corn silk. Corn silk is used in traditional medicine in many countries throughout the world, including China, Turkey, Serbia, the United States, and France, to treat conditions like cystitis, edoema, kidney stones, diuretics, prostate diseases, urinary infections, bedwetting, and obesity. According to recent studies, maize silk increases bile flow, has neuroprotective properties against oxidative stress, has anti-fatigue activity in animals by decreasing the generation of blood lactic acid, and has anticancer properties. Due to the lack of knowledge on the antibacterial action of maize, indicator species are needed to evaluate the ecotoxicity of contaminated soils.

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In order to learn more about the antimicrobial properties of corn silk, roots, and leaves, researcher observed antifungal properties against fluconazole compounds and antimicrobial activity against cefixime antibiotics in the current study.

MATERIALS AND METHODS

Plant material collection

Zea mays leaves, root and corn silk were collected from the different places Shikohabad, Firozabad at the agriculture field in the year of 2021. The maize plant was collected in the month of April to June 2021.

Preparation of plant extract

The *Zea mays* leaves, root and silk were removed following accepted best practices [11]. The plant components were mechanically ground into powder after being dried in the shade. Using a Soxhlet extractor, the plant material powder (25.0 g) was first defatted for 48 hours lower than the boiling point of the solvent using an ethanol solvent (60–80°C). The extracts were filtered while still hot using Whatman filter paper (No. 1), and it was concentrated under decreased pressure and vacuum using a rotary flask evaporator before being desiccated. 4.20 gm of dark greenish solid residue was produced. This extraction technique produced higher extract yields. Then, the extracts were kept for future use, in sterile vials in a cool atmosphere. By evaporating the solvent, the plant extracts were made dry, and the dry weight was used to calculate the concentration in mg/ml. The extract was kept at a low temperature. The possibility for having antibacterial activities was further investigated using these crude extracts of *Zea mays* plant.

Test microorganism and growth media

Pseudomonas aeruginosa, a bacterial strain, and *Penicillium expansum*, a fungal strain, were chosen due to their clinical and pharmacological significance.[12] The Dr. B.R. Ambedkar University's Khandari Campus Department of Microbiology provided the bacterial strains that were used to test the antibiotic activity. Following cooling storage at, on nutrient agar and sabourod dextrose agar (SDA) medium, the bacterial and fungal stock cultures were grown for 24 hours at 35°C, respectively. The bacteria were cultivated in nutritional broth at 35°C and kept on nutrient agar slants at cold condition before being cultured on Nutrient agar plates., whereas *Penicillium expansum* was grown in Sabouraud dextrose agar medium, respectively, at 27°C. The stock cultures were stored at room temperature.

Microbial assay

Antimicrobial assay

With a glass spreader, 0.1ml of a fresh microbial culture was applied to a nutrient agar plate. The petri plates were then incubated in an incubator at 37 °C for 24 hours after being placed in a refrigerator for 30 minutes to allow pre-diffusion of the extract. The zone of inhibition was measured to assess the antimicrobial screening. Extracts from *Zea mays* were tested for their in vitro antibacterial and antifungal effects. The agar disc diffusion method was used to examine the antibacterial and antifungal properties of plant component extracts against *Pseudomonas* bacteria and *Penicillium* fungus [13-15]. The antibacterial and antifungal effects of each extract were evaluated against the bacteria *Pseudomonas aeruginosa* and the fungus *Penicillium expansum*. Using nutrient agar tubes, sets of seven dilutions of *Zea mays* extract and standard medications (200, 100, 50, 25, 12.5, 6.25, and 3.125 µg/ml) were made. Indicator bacterial strains were planted on nutrient agar plates, which were then kept at 37ºC for three hours. Fluconazole, which has antifungal properties, and cefixime, which has antibacterial properties, were used as standard medications in control studies carried out under comparable circumstances. By measuring the sizes of the inhibitory zones on the agar surface around the discs, it was possible to assess how sensitive the various microbe species were to the plant extracts.

Antibacterial assay

For the purpose of evaluating the antibacterial activity of plant extracts, the disc diffusion method was used. Overnight, the bacterial strain was raised in nutrient broth at 28 °C. A thick grass was created on the Nutrient agar plate using the *Pseudomonas aeuriginosa* inoculum (100 µl). Then, 30 µl of the plant extract sample were impregnated into a paper disc. Plant extracts were diluted in concentrations of 200, 100, 50, 25, 12.5, 6.25, and 3.125 µg/mL. The clear zone of inhibition that surrounded the discs were measured in mm (diameter).

Antifungal assay

For the purpose of evaluating the antifungal activity of plant extracts, the disc diffusion method was used. Overnight, the bacterial strain was raised in nutrient broth at 28 °C. A thick grass was created on the Sabourod Dextrose Agar plate using the *Penicillium expansum* inoculum (100 µl). Then, 30 µl of the plant extracts sample were impregnated into a paper disc. Samples were diluted in concentrations of 200, 100, 50, 25, 12.5, 6.25, and 3.125 µg/mL. The clear zone of inhibition that surrounded the discs were measured in mm (diameter).

RESULTS AND DISCUSSION

Antifungal activity of Zea mays plant extract

The maximum zone of inhibition found at 200µg/ml concentration is 18mm in MLE (Maize leaves extract), 12mm in MSE (Maize silk extract) and 8mm in MRE (Maize root extract) plant extract. Highest zone of inhibition found in *Zea mays* leaves extract that was 18mm nearest fluconazole compound.

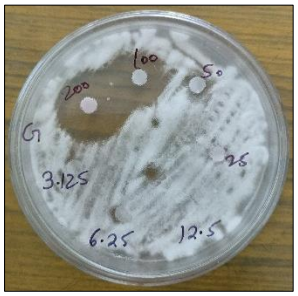

Fig 1 Fluconazole reference compound

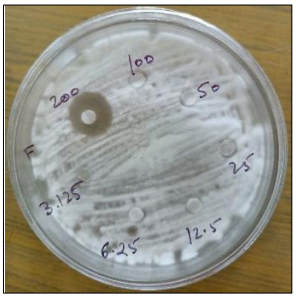

Fig 2 MLE (Maize leaves extract)

Fig 3 MRE (Maize root extract)

Fig 4 MSE (Maize silk extract)

Plate 1 Shows antifungal activity of *Zea mays* plant

Table 1 Antifungal activity- Inhibition zone (mm)

Concentration µg/ml	Reference	MLE	MSE	MRE
200	22	18	12	8
100	12	5	9	7
50	10	5	8	7
25	8	5	5	6
12.5	6	5	7	8
6.25	7	6	6	7
3.125	8	9	8	6

Antibacterial activity

Antibacterial activity of Zea mays plant extract

The maximum zone of inhibition found at 200µg/ml concentration is 12mm in MSE, 8mm in MRE and 8mm in MLE plant extract. Highest zone of inhibition found in *Zea mays* Silk extract that was 12mm nearest reference compound cefixime antibiotic.

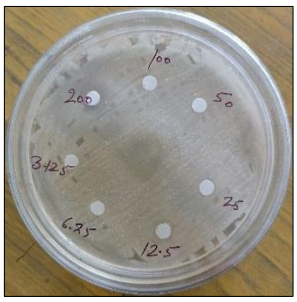

Fig 1 Cefixime antibiotic

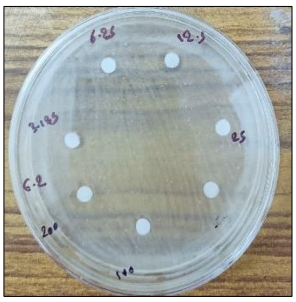

Fig 2 MSE (Mays silk extract)

Fig 3 MRE (Mays root extract)

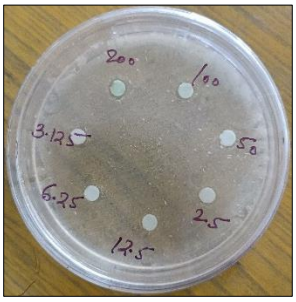

Fig 4 MLE (Mays leaves extract)

Plate 2 Shows antibacterial activity of *Zea mays* plant

Table 2 Antibacterial activity- Inhibition zone (mm)

Concentration µg/ml	Reference	MLE	MSE	MRE
200	18	8	12	8
100	12	8	9	7
50	8	7	7	7
25	7	6	6	6
12.5	5	5	5	7
6.25	5	5	5	6
3.125	5	5	5	6

CONCLUSION

The development of microbial resistance to the available antimicrobial medicines is mostly to blame for the fact that microbial infections have recently grown to be a substantial clinical danger with significant associated morbidity and mortality. Many experts from all around the world were looking into the antibacterial properties of various plants. *Zea mays* Silk extracts in ethanol solvents have high antibacterial properties. The aforementioned finding indicates that certain plant species' silk extracts have the ability to serve as antimicrobial agents against *pseudomonas* bacteria and can be used to treat infectious disorders brought on by a variety of germs. The results of the aforementioned experiment lead us to the conclusion that the ethanol extracts of the Silk extracts exhibited the strongest antibacterial activity. Many experts from all around the world were looking into the antibacterial properties of various plants. *Zea mays* leaf, root and silk in various solvents have antibacterial properties. The aforementioned finding indicates that certain plant species' leaf extracts have the ability to serve as antimicrobial agents against bacteria and can be used to treat infectious disorders brought on by a variety of germs. We can infer from the aforementioned experiment's findings that the ethanol extract of the silk had the highest antibacterial activity. *Pseudomonas aeruginosa*, which can cause infections in the blood, lungs (pneumonia), or other parts of the body after surgery. The aforementioned finding indicates that certain plant species leaves, corn silk and root extracts have the ability to serve as antifungal agents against *Penicillium* fungus and can be used to treat infectious disorders brought on by a variety of fungi. The results of the aforementioned experiment lead us to the conclusion that the ethanol extracts of the bark exhibited the strongest antifungal activity.

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