Preliminary Studies on the antibacterial properties of essential oil extracts from five folk medicines

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Abstract

In folk medicine, many plants have been claimed to have antibacterial properties. To establish the antimicrobial properties and the therapeutic value of such plants, investigations have to be conducted. In this study, essential oils extracted from the seeds of the five plants of the umbelliferae family including Apium graveolens, Ferula copoda, Cnmminum cyminum, Foeniculum vulgare and Trachyspermum ammi have been examined for antimicrobial activity.
The data showed that these essential oils possess considerable antibacterial activity against Streptococcus pyogenese, Staphylococcus aureus and Escherichia coli, isolated from patients suffering from ENT and urinary infections. Their activity was comparable or even greater than penicillin, streptopenicil-lin and tetracycline. It is conceivable that oils either themselves exert antimicrobial effect or some active principles are present in them. Further pharmacological studies are needed to prove their efficiency in systemic infections at safe dosage levels (JPMA 31:230, 1981).

Introduction

Due to the ever-increasing problem of resistance of microorganisms to known chemo-therapeutic agents, the interest in plant extracts exhibiting antimicrobial activity has been on the increase in recent years. Some of the recent reports on the antibacterial activity of extracts of plants include those of Malcolm and Sofowora (1969), Mitcher et al. (1972), Su et al. (1973), Buadu and Boakye-Yiadom (1973), Bha-kuni et al. (1974), and Boakye-Yiadom and Konning (1975). Many indigenous medicinal plants have also been claimed to possess antibacterial properties in the folk medicine (Nad-karni, 1954; Said, 1969). They have been empirically used for many and varied medicinal purposes such as remedies for throat, chest and urinary infections (Ashraf and Bhatty, 1979). In order to establish their antimicrobial properties and real therapeutic value, investigations have to be carried out. Thus, in this study, five essential oils extracted from Apium graveolens (Celery, Krisf or Ajmud), Cuminum cyminum (Cumin seed or Safed-Zira) Ferula copoda (Chir), Foeniculum vulgare (Fennel or Bari-Sonf) and Trachyspermum ammi (Omum seed or Desi-Ajowan) have been examined for antimicrobial activity against three common pathogenic bacteria, isolated from patients suffering from ear, nose, throat and urinary infections.

Material and Methods

Essential Oils:

The essential oils of Apium graveolens, Cuminum cyminum, Feralu copoda, Foeniculum vulgare and Trachyspermum ammi were extracted and supplied by PCSIR Laboratories, Lahore. The chemistry and other features of these essential oils have been described by Ashraf and Bhatty (1979).

Test Microorganisms:

Proven pathogenic strains of Streptococcus pyogenese (Strept pyogenses), Staphylococcus aureus (Staph' aureus) and Escherichia coli (E. coli) were employed as test organisms. The first two of these bacteria were isolated from patients suffering from ear, nose and throat infections and E. coli from

patients with urinary tract infections. Prior to testing, the isolates were characterized and identified by various morphological, biochemical and serological tests; and pathogenicity of these organisms was checked in rabbits and mice (Naseer and Afzal, 1978; Shahdin et al., 1979; Ijaz et al., 1980).

Preparation of Discs:

Impregnated paper disc method of Louis and Dean (1965), was used for testing antibacterial action. Discs of 7 mm diameter were cut from filter paper of Whatman No. 1. These discs were placed in the petri dishes and sterilized in hot air oven, 0.02 ml of the original oil was dropped on to each disc, and then kept in incubator at 37±1°C. The standard antibiotic discs of Penicillin G, Streptopenicillin (COMBIO-TICS) and Tetracycline were used as control.

Antibacterial Test

The method recommended by Barry (1976) and Casals and Pedersen (1977) was followed. The sterilized nutrient broth in the tubes was inoculated with different bacteria and incubated at 37°C for 24 hours. Then, from every tube, 0.1 ml of liquid broth culture of organisms was uniformly inoculated on the solid blood agar plates. Discs of test oils along with the standard antibiotics, were placed on the blood agar plates previously seeded with bacteria. Zones of inhibition due to activity of test oils/antibiotics were measured after 24 hours of incubation at 37°C. The diameters of zones of inhibition were determined in mm. The values are given as means± S.E.M. and Student's t-test was applied to test their significance.

Results and Discussion

Seeds of the plants of Umbelliferae family have been empirically used in the folk medicine for centuries, to treat pharyngitis, bronchitis, pneumonia, asthma, cholera, cough and gastrointestinal disorders (Nadkarni, 1954; Said, 1969). Recently, Ashraf and Bhatty (1979), extracted essential oils from many plants of this family, and reported that some of them exert antibacterial action. In this study, we have specifically examined the antimicrobial effect of five of these essential oils, on three proven pathogenic bacterial strains, isolated from human patients, suffering from ENT and urinary infections. The results are summarized in the accompanying figure, which shows that all these oils have exerted considerable antimicrobial effect on the test bacteria except that E. coli was not sensitive to Cuminum ajminum. In all experiments, the controls (without test discs) showed heavy growth of microorganisms. The oil of Apium graveolens showed more activity against Strept. pyogenese, followed by E. coli and Staph, aureus. The Cuminum ajminum oil showed similar result, except that it was ineffective against E. coli. The Ferrula copoda oil showed greater activity against Strept. pyogenese, followed by Staph, aureus and E. coli. The Foeniculum vulgare oil, on the other hand, was more active against E. coli, followed by Strept. pyogenese and Staph, aureus. Of all the oils, Trachyspermum ammi proved to be most potent against the organisms tested. It was more active against Strept. pyogenese, followed by Staph, aureus and E. coli.

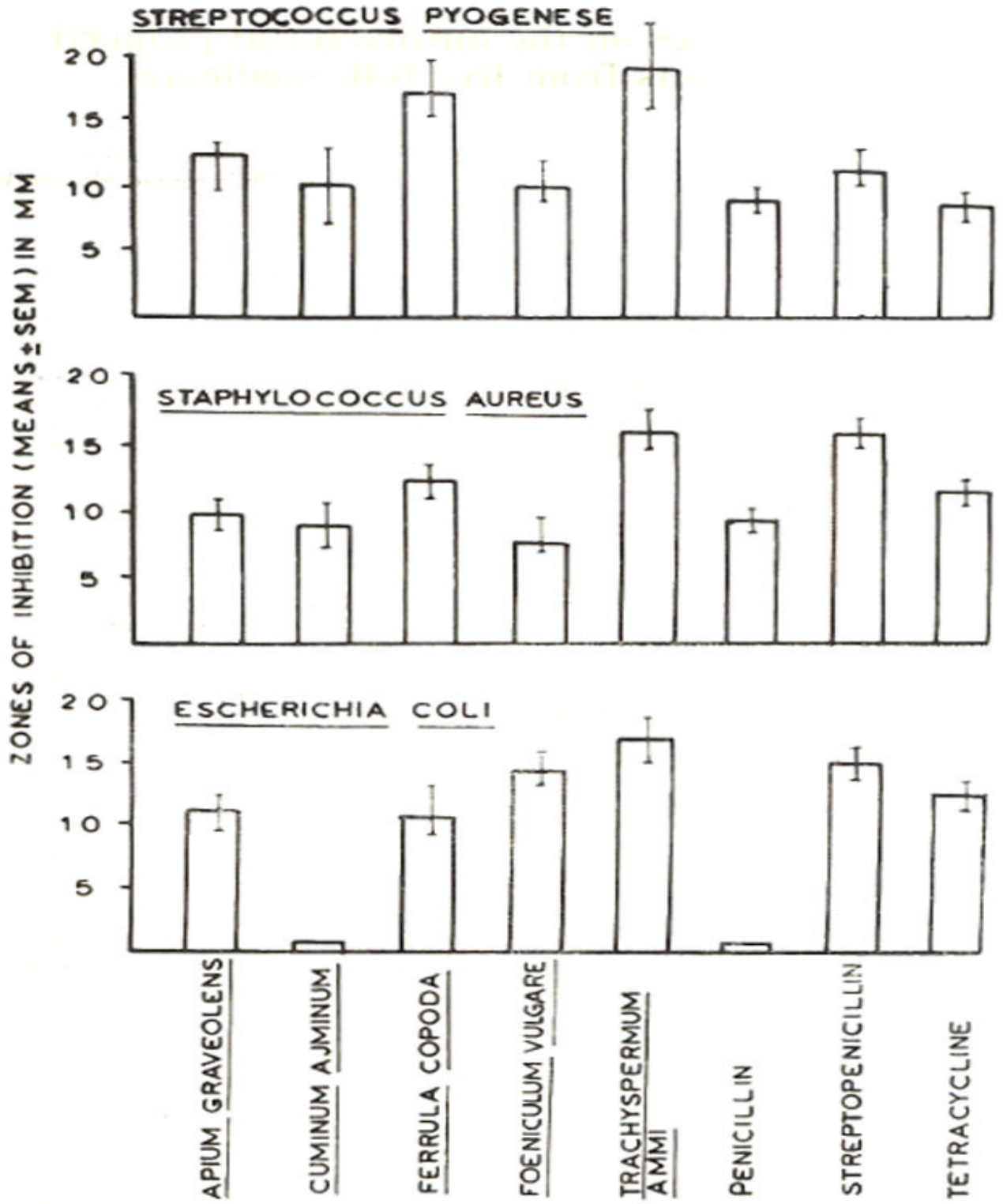

Fig. Relative Sensitivity of 3 Pathogenic Bacteria To Certain Essential oils and Antibiotics.

The figure also shows that the antimicrobial activity of these oils was in some cases comparable and in others even more than those of the standard antibiotics. Strept. pyogenese showed sensitivity to Ferrula copoda and Trachysperum ammi, even more than streptopeni-cillin and tetracycline. The Staph, aureus was equally insensitive to Trachyspermum ammi and streptopeniciilin. The E. coli was more sensitive

to Trachyspermum ammi than streptopeniciilin and tetracycline. The E. coli, as already established, was found to be resistant to penicillin.

These observations suggest that these essential oils possess marked antibacterial properties. It has, however, not yet been investigated as to whether certain antimicrobial principles are contained therein or the oils themselves possess this action. It is not yet known whether they would also be effective in systemic infections and their safe dosage levels. Further studies are therefore, being conducted.

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