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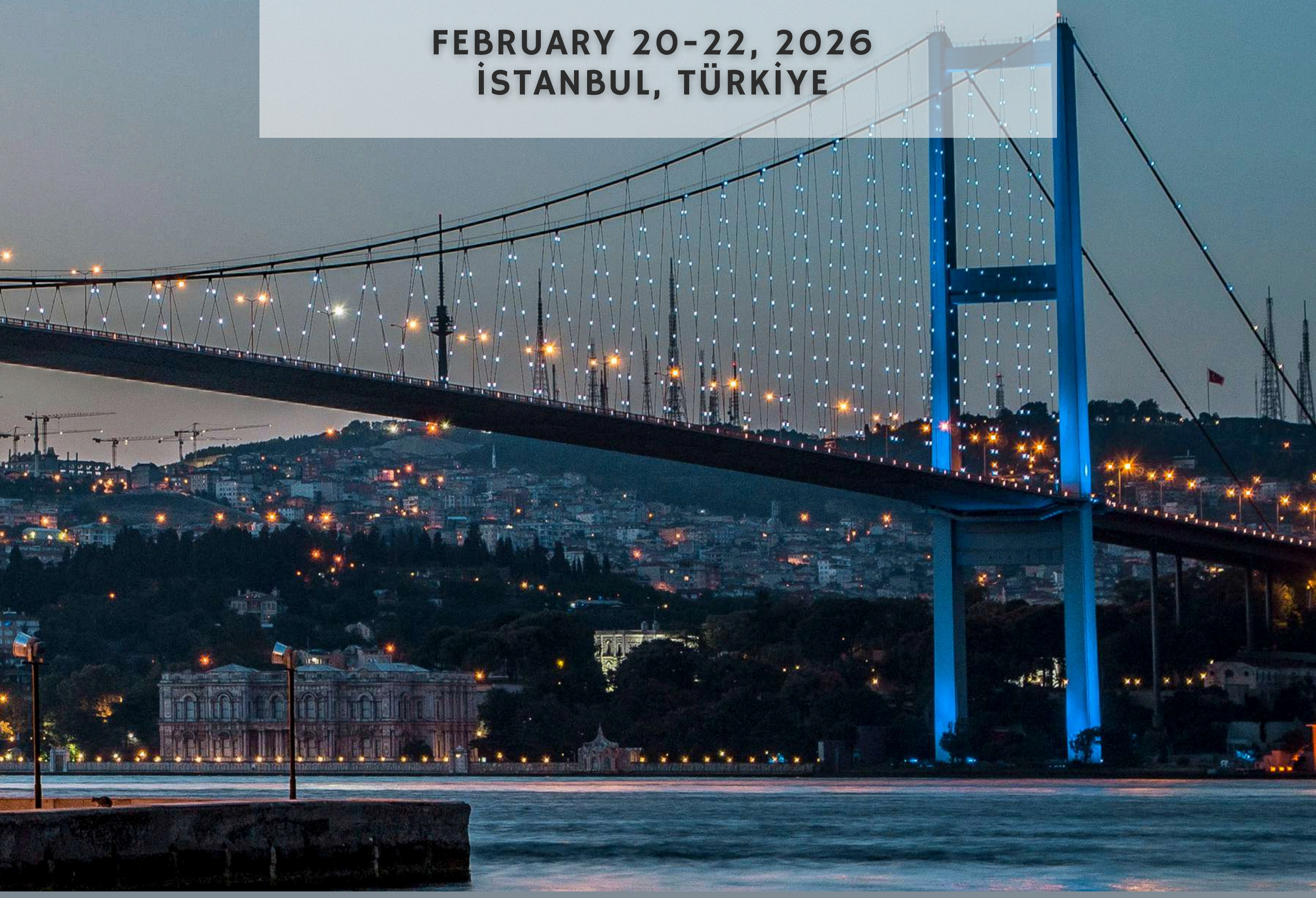
# 24TH INTERNATIONAL ISTANBUL SCIENTIFIC RESEARCH CONGRESS ON LIFE, ENGINEERING, ARCHITECTURE, AND MATHEMATICAL SCIENCES PROCEEDINGS BOOK

FEBRUARY 20-22, 2026
İSTANBUL, TÜRKİYE



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**FEBRUARY 20-22, 2026**

**ONLINE & IN-PERSON PARTICIPATION**

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PROCEEDINGS BOOK

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Kurumunuz Fen Fakültesi, Analitik Kimya Anabilim Dalı'nda öğretim üyesi olarak görev yapan Prof. Dr. Habibe ÖZMEN'in 20-22 Şubat 2026 tarihinde ZOOM üzerinden çevrimiçi; İstanbul'da yüz yüze olarak gerçekleşecek ***24. Uluslararası İstanbul Fen, Mühendislik, Mimarlık ve Matematik Bilimlerinde Bilimsel Araştırmalar Kongresi***'nde açılış konuşmacısı, bilim ve organizasyon kurulu üyesi olarak yer almasını talep eder; ilgili görevlendirme yazısını tarafınızca arz ederiz.

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**20-22 ŞUBAT 2026**

**YÜZ YÜZE & ÇEVRİMİÇİ**

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Türkiye dışından toplam **5 farklı ülkeden açılış konuşmacısı; 18 farklı ülkeden katılım (detaylar kongre bildiri kitabında yer alan kongre programında yer almaktadır)** sağlanmış olup, 346 adet bildirinin 202 tanesi yabancı, 144 tanesi Türk katılımcı tarafından sunulmuştur. Kongrenin yabancı katılımcı oranı %58'dir.

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# ASSESSMENT OF *MEDICAGO SATIVA* L. (FABACEAE) AS A NATURAL ANTIBACTERIAL AGENT

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## ABSTRACT

*Medicago sativa*, a member of the Fabaceae family, is a plant which is perennial species belonging to Asia. *M. sativa* is utilized in medicinal fields, livestock management, and food production. In addition to serving as animal feed, it is notably utilized as a food ingredient in the USA, Russia, China, and North Africa because of its bioactive ingredients and elevated vitamin content. It is favoured due to its content of enzymes, including pectinase and amylase, which enhance digestion. According to the literature, phytochemical analysis of *M. sativa* shows the presence of phenolic compounds such as flavonoids, alkaloids, vitamins, saponins, and triterpenes. These characteristics facilitate its application in the medical domain, making it a recognized therapeutic plant. The medicinal benefits of *M. sativa* include activities that are antioxidant, anti-inflammatory, antidiabetic, antifungal, antibacterial, anticoagulant, and anticancer. The scope of our research encompasses that water, ethanol, and methanol extracts were prepared from naturally obtained *M. sativa*. The antibacterial efficacy of the extracts against *Staphylococcus aureus* and *Escherichia coli* was assessed using the disk diffusion method. The findings indicated that *M. sativa* functions as a natural antibacterial agent.

**Keywords:** *Medicago sativa,* Extraction, Antibacterial effect, Disc diffusion.

## INTRODUCTION

*Medicago sativa*, also known as alfalfa, is a perennial forage plant belonging to the Fabaceae family. Originating in Asia, alfalfa production has remained at high levels globally throughout history due to its high nutritional content and excellent adaptability to diverse climatic conditions. Alfalfa plant parts include roots, rhizomes, stems, petioles, leaves, and flowers (Uslu & Kaya, 2021). The flower parts have a various colour, the most common being purple, variegated, yellow, cream, and white (Figure 1).

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**Figure 1**. Image of *Medicago sativa* L. (Uslu & Kaya, 2021).

The scientific classification of *Medicago sativa* is as follows (Heywood and Ball, 1968):

Kingdom: Plantae

Division: Magnoliophyta;

Class: Magnoliopsida;

Order: Fabales;

Family: Fabaceae;

Subfamily: Faboideae;

Tribe: Trifolieae;

Genus: *Medicago*;

Species: *sativa*;

Binomial name: *M. sativa* Linn.

*M. sativa* has strong roots that can penetrate up to 6 meters deep into the soil (Bora & Sharma, 2011). Thanks to its extremely long roots, *M. sativa* can utilize water and nutrients found deep within the soil and transport these substances to the upper layers of it. In this way, it helps to make the soil more fertile for subsequent crops (Uslu & Kaya, 2021).

Due to its high nutritional value and vitamin content, it can be used as animal feed. This feed can be used as green fodder in the spring months, and in dried form in the winter months (Uslu & Kaya, 2021). Furthermore, owing to its high vitamin and bioactive component content, it is used in food products from China to America and from Russia to North Africa (Chandra et al., 2023).

Due to its diverse biological activities, *M. sativa* holds a significant place in pharmacology, and its medicinal use is quite widespread today. The phytochemicals found in *M. sativa* include terpenes, alkaloids, carotenoids, amino acids, flavonoids, minerals, phenolic compounds, phytosterols, and saponins (Bora & Sharma, 2011). Scientific studies have shown that, it exhibits antioxidants (Sadeghi et al., 2016), anti-inflammatory (Hong et al., 2009), antidiabetic (Farsani et al., 2016), antifungal

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(Sadowska et al., 2014), antibacterial (Chegini et al., 2018), and anticancer (Gatouillat et al., 2015) properties. In addition, it can be used medically to treat various disease conditions such as respiratory diseases like asthma and cough, gastrointestinal diseases like stomach ulcers, kidney disorders, as diuretic, to increase peristaltic bowel movements, and to promote wound healing (Chaudhary et al., 2020).

This study aimed to determine the antibacterial activity of *M. sativa*, a plant grown in Türkiye and possessing valuable phytochemical content. Therefore, water, ethanol, and methanol extracts of *M. sativa* were prepared, and their antibacterial activity against *Staphylococcus aureus* and *Escherichia coli* was determined.

## MATERIALS AND METHODS

### Obtaining and Preparing Extract of *Medicago sativa*

*Medicago sativa* (Fabaceae) was collected from Türkiye (2022). All plant sample was cleaned and dried according to the Davis herbarium techniques (Davis, 1972). Dried plant sample was grounded and 15 gr sample weighed. 150 ml of each solvent (distilled water, methanol, and ethanol) was added to the ground plant sample and stored in sealed glass jars for 2 days. At the end of incubation, the samples were filtered and the solvents evaporated.

### Antibacterial Activity of *Medicago sativa*

*E. coli* and *S. aureus* strains were cultured on Tryptic Soy Broth (TSB) medium for the experiment, followed by incubation at 37°C for 24 hours. After incubation, these strains were inoculated onto sheep blood agar and incubated at 37 °C for 24 hours. The bacterial concentration was set at 0.5 McFarland ($10^8$ CFU/mL). Then, the bacterial culture was spread on Luria Bertani (LB) agar. At the same time, after distilled water was added to the prepared extracts, the extracts were soaked onto empty sterile discs with a diameter of 6 mm that did not contain antibiotics and left to dry under aseptic conditions. The prepared discs were placed evenly spaced on LB agar in a petri dish. Amoxicillin (25 µg), Tetracycline (30 µg) and Streptomycin (10 µg) were used for positive control and distilled water were used for negative control. The inhibition zone of the extracts was measured along with the diameters of the discs (6mm) after incubation. Each experiment was repeated three times.

## RESULTS

The effect of *M. sativa* L. on *E. coli* is presented in Table 1, while its effect on *S. aureus* is presented in Table 2. Considering the results, the inhibition zones of extracts prepared from *M. sativa* on *E. coli* were measured as 9.2 mm for methanol, 8.6 mm for ethanol, and 7.2 mm for distilled water.

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**Table 1**. Antibacterial activity of *Medicago sativa* extracts against *E. coli* (disk diffusion method)

| **Treatment** | **Inhibition zone (mm)** |
|---|---|
| Control (distilled water) | 6.0 ± 0.0 |
| Water extract | 7.2 ± 0.8 |
| Ethanol extract | 8.6 ± 1.1 |
| Methanol extract | 9.2 ± 1.3 |
| Amoxicillin | 14.1 ± 1.5 |
| Ampicillin | 10.6 ± 1.4 |
| Tetracycline | 23.4 ± 1.6 |
| Streptomycin | 12.1 ± 1.5 |

All inhibition zone data were measured. Inhibition zone diameters are expressed as mean ± SD (mm).

The inhibition zones of *M. sativa* extracts *on S. aureus* were measured as 11.9 mm for methanol, 10.4 mm for ethanol, and 8.2 mm for distilled water.

**Table 2**. Antibacterial activity of *Medicago sativa* extracts against *S. aureus* (disk diffusion method)

| **Treatment** | **Inhibition zone (mm)** |
|---|---|
| Control (distilled water) | 6.0 ± 0.0 |
| Water extract | 8.2 ± 0.9 |
| Ethanol extract | 10.4 ± 1.2 |
| Methanol extract | 11.9 ± 1.4 |
| Amoxicillin | 18.6 ± 1.7 |
| Ampicillin | 17.3 ± 1.5 |
| Tetracycline | 15.1 ± 1.8 |
| Streptomycin | 9.4 ± 1.6 |

All inhibition zone data were measured. Inhibition zone diameters are expressed as mean ± SD (mm).

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The results obtained showed that the methanol extract of *M. sativa* was more effective against *E. coli* (9.2 mm) and *S. aureus* (11.9 mm) than the water and ethanol extracts.

## DISCUSSION

Sepsis is among the serious health problems that threaten human life. Therefore, it is an important commodity globally. Analyses have revealed that sepsis is the most common cause of hospital deaths even in the United States. It is also known that the annual cost of this condition exceeds $24 billion (Liu et al., 2014; Rudd et al., 2020). According to the World Health Organization, it is estimated that approximately 11 million deaths worldwide each year are due to sepsis (Rudd et al., 2020). The indiscriminate use of antibiotics not only leads to the emergence of pathogens that develop multi-drug resistance but also complicates the fight against sepsis. Therefore, the search for new antibiotics continues today.

People have used plants as natural remedies since ancient times. Therefore, while medicinal plant cultivation is practiced today, numerous studies are being conducted to observe the effects of the secondary metabolites contained in plants found in nature. Studies conducted worldwide show that these metabolites can be used in traditional medicine not only for the treatment of various diseases but also for the treatment of infections. Therefore, it is necessary to shed light on the power of plants to fight infection agents.

Alfalfa (*Medicago sativa* L.) is commonly known as the ‘queen of forages’. The word “alfalfa” is derived from the Arabic word ‘Al-Fasfasa’. This term means ‘father of all plants’ (Lacefield et al., 1979; Zhou et al., 2024). Beyond its use as feed, the plant is known as a therapeutic agent for treating various diseases. Studies assessing its antimicrobial activity have gained significant prominence in recent times. Some of the studies are presented below.

Chegini and colleagues (2018) prepared an extract from *M. sativa* roots using the maceration method and demonstrated the extract's antibacterial properties against *Streptococcus pneumoniae, Haemophilus influenzae, Moraxella catarrhalis*, and *Staphylococcus aureus* bacteria. The findings of the study indicated that the extract was more effective against *Moraxella catarrhalis* than against other bacterial species. Furthermore, it was reported that the efficacy of the extract against *S. aureus* was not observed using the disc diffusion method.

In another study conducted with *M. sativa* in India, extracts of the plant were prepared using different solvents such as petroleum ether, chloroform, benzene, methanol, ethanol, and water. The antibacterial activities of the prepared extracts were determined using the disc diffusion method. In the experiment, *Staphylococcus aureus* and *Streptococcus pyogenes* MTCC 1928 were used as gram-positive bacteria, while *Proteus mirabilis* MTCC 425, *Escherichia coli* MTCC 2961, *Pseudomonas aeruginosa* MTCC 4676, *Klebsiella pneumoniae* MTCC 432, and *Salmonella typhi* MTCC 733 were used. In the study, the antibacterial activities of methanol, chloroform, and ethanol extracts were determined, and it was

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observed that petroleum ether had no antibacterial activity. The activity of the methanol extract against *S. aureus* was 18.1 mm, and this result was observed to have the best antibacterial activity compared to the other extracts. The activity against *E. coli* was also observed to have the highest zone diameter in the methanol extract, as was the case with *S. aureus* (Doss et al., 2011).

In a different study carried out by Chavan et al., the antibacterial activities of extracts prepared from *M. sativa* leaves using methanol and petroleum ether against *E. coli, P. aeruginosa*, and *S. aureus* were determined. The results obtained from the disc diffusion test showed that the methanol extract from *M. sativa* leaves had the highest antibacterial activity (Chavan et al., 2015).

*M. sativa* contains numerous secondary metabolites such as alkaloids, flavonoids, tannins, and steroids. Some of these metabolites exert antibacterial effects on bacteria. In particular, the tannin metabolite is known to have the ability to break down the bacterial cell wall (Venkataswamy et al., 2010). Another metabolite frequently found in plants is saponins. Saponins are known to be mild detergents. Studies have shown that this property gives them antibacterial properties (Chavan et al., 2015).

The results obtained in our study reveal that the methanol extract of *M. sativa* has significant antibacterial activity against both *E. coli* and *S. aureus* compared to positive controls. It is believed that our study with *M. sativa* will make a significant contribution to the literature.

## CONCLUSION

Within the scope of this study, the in vitro antibacterial activity of extracts obtained from *Medicago sativa* L. against *Staphylococcus aureus* ATCC 29213 and *Escherichia coli* ATCC 25922 bacterial strains was investigated. After drying, the plant was extracted using different solvents (methanol, ethanol and distilled water). The antibacterial activity of the extracts obtained from *Medicago sativa* L. was determined using the disc diffusion method. According to the results, the highest antibacterial activity against *Staphylococcus aureus* was observed with the methanol extract, with an inhibition zone measured at 11.9 mm.

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