An ethnobotanical approach to MRSA (Methicillin-Resistant *Staphylococcus aureus*) in Western Anatolia: A case of Afyonkarahisar

Süleyman Arı*, a, Mehmet Temel a & Muhsin Konuk b

aScience & Arts Faculty, Department of Molecular Biology and Genetics, University of Afyon Kocatepe, Afyonkarahisar, Turkey;
bDepartment of Molecular Biology and Genetics, Faculty of Engineering and Natural Sciences, Üsküdar University, 34662 Istanbul, Turkey

E-mail: slymanari@hotmail.com

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MRSA (Methicillin-Resistant *Staphylococcus aureus*) has been recognized as an important pathogen leading to the problems in the hospitals worldwide. Currently, treatment options for MRSA infections are limited to both very few and expensive drugs such as Teicoplanin, Vancomycin and Linezolid. The difficult and expensive methods to combat the pathogens have led people to search the natural way of healing with medicinal plants. In this study, an ethno botanical approach to MRSA pathogens has been shown by using medicinal and aromatic plants. Field studies were carried out in the Inner Western Anatolia, and interviews were performed with 11 people, (8 males and 3 females) whose age ranged between 50 and 75, who have had an operation and were infected with MRSA. They have also been cured with medicinal plants as ethno-botanical practices or have been undergoing a cure during the study carried out. 21 plant species belonging to 16 families were identified and their ethnobotanical uses to MRSA were determined. Their Latin name, local name and usages were indicated. An ethnobotanical approach was exhibited to struggle with the pathogen MRSA. A different approach to cure MRSA is presented.

Keywords: MRSA, Ethnobotany, Medicinal plants, Afyonkarahisar, Turkey

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MRSA (Methicillin-Resistant *Staphylococcus aureus*) has been known as one of the important hospital pathogens all over the world. It is necessary to develop new antibacterial agents urgently since the emergence of resistant strains of bacteria has reached an alarming level. Resistant strains of bacteria increase, especially due to the widespread use of antibiotics. It can be difficult to eradicate MRSA pathogens and cope with them. Moreover, there is the possibility for spreading the epidemics. Currently, treatment choices for MRSA infections are limited to very few and use expensive drugs such as Teicoplanin, Vancomycin and Linezolid. They can acquire resistance to Vancomycin during drug utilization against *Enterococci*. As a result, the pathogens caused by strains of MRSA emerge in the hospitals. It is essential to reduce the spread of MRSA infections. Their continuous emergence in hospitals and development of resistance to existing antibacterial agents by bacteria necessitate designing and synthesizing new antibacterial compounds that exhibit activity against these resistant strains. A substantial part of the studies conducted in the plants for medical purposes are towards the discovery of antibacterial agents. People have turned to alternative medicine and medical plants to fight against the MRSA infections. In the United States, more than 94,000 patients were admitted to the hospital because of MRSA each year and nearly 19,000 of these resulted in death. This death toll is greater than that caused by AIDS.

Medicinal plants were used throughout human history for various purposes. Creating an important culture for future generations through transferring accumulation of knowledge from generation to generation is an important issue. World Health Organization estimated that more than 21,000 plant species have been used for the purpose of medical therapy. Turkey has a great ethnobotanical culture. It has intensively benefited from medicinal plants in Turkey since ancient times. Roughly 10,500 plant species have been identified in Turkey up to now and

*Corresponding author
more than 30% of these are endemic to Turkey. In 2002, a paper reported that about 1,100 plant species were used for medicinal purposes in Turkey. Medicinal and aromatic plants are used to treat both animal and human diseases (Fig. 1). As Turkish people have placed great importance to use of medicinal plants in order to recover from the illness, many studies have recently been published about usages of medicinal plants in Turkey. The People in the study, who live in and around Afyonkarahisar, have undergone surgery in the hospitals due to different ailments and exposed to MRSA infections. Some have recovered from these pathogens by modern medical solution while some have still been struggling with these ones. Such people are attempting to find medicinal and ethno botanical solutions in order to recover from MRSA. They have benefited from the plants with different methods by obeying to their ancestors’ traditional cultural history against MRSA.

This study was aimed to determine medicinal and aromatic plants against MRSA and their other usages.

Materials and methods

Plant materials

Benefited medicinal plant samples for MRSA were collected from the field and their identifications were performed using Flora of Turkey. Specimens identified are kept in the Herbarium of Afyon Kocatepe University (AKUH).

Study area

Turkey is one of the rare countries where natural and cultural wealth are combined and its each one region has rich plant diversity in terms of their distribution areas and endemism rates. Turkey with different climatic, geographic and geologic zones has a rich and diverse flora. Endemism rate is 34.4%, with the number of endemic plants that is more than 3,000 taxa. Anatolia has accumulated a rich ethnobotanical culture and heritage results from the fact that it has been a host to many different cultures and civilizations. Turkish community has relied heavily on use of herbal drugs in the treatment of daily diseases and ailments over centuries. Afyonkarahisar is located in the inner part of the Aegean region and phytogeographically shows the transition between Irano-Turanian and Mediterranean regions. Euro-Siberian elements are also available in this area. The study area is at an altitude of about 1050 m, predominant climate type is continental, annual rainfall is 388 mm, average annual temperature is 10.7 °C, the hottest month is July with 20 °C and the coldest month is January with 4.8 °C (Fig. 2). Afyonkarahisar was under the domination of Hittite and then entered into the domination of Phrygia and Lydia, respectively. Having a deep-rooted historical background also increases the transmission of traditional culture. A high plant diversity in Afyonkarahisar results from the richness of the mountains with different flora around it. Sultandağları, Akdağ, Emirdağları, Kumalar Dağı,
Ahır Dağı, Kızıldağ, Paşa Dağı, Kasım Dağı, Kirseli Dağı, İlbulak, Asar Dağı and Eyer Dağı are some of these mountains, which contribute significantly to this plant diversity.

Interviews with local people
The people who have an ethno-medicinal knowledge or experience on MRSA healing were visited at least four-five times while they were in houses, fields, plateaus and farms at different seasons of the year. Information about usage of medicinal plants was obtained from these people using a questionnaire. In 2015, we interviewed 30 people capable of recognizing the plants well during the field surveys. 11 out of 30 people (8 man and 3 women, aged between 50 and 75), were infected with the MRSA. The information about ethnobotanical usage of the plants against MRSA was obtained from their experience. We observed that patients who underwent an operation for a variety of diseases (herniated disc, orthopedic surgery, etc.) in Afyonkarahisar, received both antibiotic treatment for a length of time and hyperbaric ozone therapy sequentially they were discharged from the hospital although they could not completely recover from this MRSA microbe. Therefore, they have often referred themselves to alternative medicine and ethnobotanical field to recover health in places where they have lived. As ethnobotanical researchers, we contacted with two of these individuals during the field visits. Finally we observed that 11 MRSA carriers established a connection between themselves by associating with each other.

Interrogating the reliability of data
Among the informants, 11 people were chosen as the main resource persons after receiving the fidelity level (FL) results. In the region, the usage information about the medicine and aromatic plants were obtained from the informants. They were at different age, marital status, education level, and employment status.

The used statistical values
Fidelity level (FL) data analysis
According to Kaval et al., the relative healing potential of each local medicinal plant should be estimated using an index referred to as fidelity level (FL) based on the proportion of informants who agreed on its use against a given ailment category. The formula for FL is given as $FL = \frac{Ip}{Iu} \times 100$, where Ip is the number of informants who independently indicated the use of a species for the same major ailment and Iu the total number of informants who mentioned the plant for any major ailment (Table 1).

Use value (UV)
The use value (UV) demonstrates the relative importance of plants known locally. It was calculated using the formula:
$$UV = \sum \frac{Ui}{N}$$
where, $Ui$ is the number of uses mentioned by each informant for a given species and $N$ is the total number of informants (Table 1).

Results
We identified 21 species belonging to 16 families, which were believed to be useful for the MRSA. We also determined their ethnobotanical uses by the locals (Table 1). Table 1 presents taxa's Latin name,
<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Botanical name/Voucher number</th>
<th>Family</th>
<th>Local name</th>
<th>Parts used</th>
<th>Preparation and Administration</th>
<th>Other medicinal uses; parts used; administration (in the study area)</th>
<th>Fidelity level (Ip/Iu x100)</th>
<th>ΣUi</th>
<th>UV</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><em>Matricaria chamomilla</em> var. recutita (L.) Grierson AKUH 2740</td>
<td>Asteraceae</td>
<td><em>Alman Papaty</em></td>
<td>Flower</td>
<td>Decoction as tea.</td>
<td>Respiratory system; flower; infusion as tea.</td>
<td>90</td>
<td>7</td>
<td>0.23</td>
</tr>
<tr>
<td>2</td>
<td><em>Marrubium vulgare</em> L. AKUH 2734</td>
<td>Lamiaceae</td>
<td>Köpek otu. Mayasyıl otu</td>
<td>Aerial organs</td>
<td>Decoction as tea.</td>
<td>Digestive diseases; leaf; infusion as tea.</td>
<td>56.6</td>
<td>9</td>
<td>0.3</td>
</tr>
<tr>
<td>3</td>
<td><em>Hypericum perforatum</em> L. AKUH 2735</td>
<td>Hypericaceae</td>
<td>Binbirdelik otu</td>
<td>Leaf, Flower</td>
<td>Infusion as tea.</td>
<td>Painkillers; aerial parts; decoction as tea.</td>
<td>63.3</td>
<td>11</td>
<td>0.37</td>
</tr>
<tr>
<td>4</td>
<td><em>Olea europaea</em> L.*</td>
<td>Oleaceae</td>
<td>Yenilen zeytin</td>
<td>Fruit</td>
<td>Crushed fruits. oil is extracted and consumed 1-2 scale</td>
<td>Cancer; flower and leaves; decoction.</td>
<td>76.6</td>
<td>13</td>
<td>0.43</td>
</tr>
<tr>
<td>5</td>
<td><em>Plantago lanceolata</em> L. AKUH 1741</td>
<td>Plantaginaceae</td>
<td>Yılandılı otu</td>
<td>Leaf</td>
<td>Decoction as tea.</td>
<td>Infection; leaf; leaf of the plant part is driven directly to the inflamed area.</td>
<td>46.6</td>
<td>4</td>
<td>0.13</td>
</tr>
<tr>
<td>6</td>
<td><em>Equisetum arvense</em> L. AKUH 2748</td>
<td>Equisetaceae</td>
<td>Kırkboğum otu</td>
<td>Leaf</td>
<td>Infusion as tea.</td>
<td>Diuretic, homeostatic and active against tuberculosis; leaf; infusion as tea.</td>
<td>50</td>
<td>3</td>
<td>0.1</td>
</tr>
<tr>
<td>7</td>
<td><em>Camellia sinensis</em> (L.) O. Kuntze*</td>
<td>Theaceae</td>
<td>Çay ağıacı</td>
<td>Leaf</td>
<td>Infusion</td>
<td>Infection and cancer, leaf; infusion as tea.</td>
<td>80</td>
<td>5</td>
<td>0.17</td>
</tr>
<tr>
<td>8</td>
<td><em>Cyclamen mirabile</em> Hildebr. AKUH 2727</td>
<td>Primulaceae</td>
<td>Domuz turpu</td>
<td>Leaf</td>
<td>Decoction as tea.</td>
<td>Infection; leaf; decoction</td>
<td>53.3</td>
<td>2</td>
<td>0.06</td>
</tr>
<tr>
<td>9</td>
<td><em>Helichrysum italicum</em> (Roth) D. Don fil. AKUH 2705</td>
<td>Asteraceae</td>
<td></td>
<td>Leaf, Flower</td>
<td>Infusion as tea.</td>
<td>Body resistance, vitamin; aerial organs; infusion as tea.</td>
<td>53.3</td>
<td>2</td>
<td>0.06</td>
</tr>
<tr>
<td>10</td>
<td><em>Eryngium thorifolium</em> Boiss. AKUH 2712</td>
<td>Apiaceae</td>
<td>Enfeksiyon otu, boğadikeni</td>
<td>Root</td>
<td>Infusion as tea.</td>
<td>Body resistance; aerial organs; decoction.</td>
<td>36.6</td>
<td>4</td>
<td>0.13</td>
</tr>
<tr>
<td>11</td>
<td><em>Thymelaea passerina</em> (L.) Coss. &amp; Germ. AKUH 2733</td>
<td>Thymelaeaceae</td>
<td>Mikrop otu, Çekem</td>
<td>Aerial organs</td>
<td>Decoction as tea.</td>
<td>Respiratory, cold; aerial organs; infusion as tea.</td>
<td>36.6</td>
<td>4</td>
<td>0.13</td>
</tr>
<tr>
<td>12</td>
<td><em>Althaea officinalis</em> L. AKUH 2710</td>
<td>Malvaceae</td>
<td>İlaç hatmi</td>
<td>Flower, Leaf</td>
<td>Applied to the pain region</td>
<td>Respiratory, cold; flower; infusion as tea.</td>
<td>36.6</td>
<td>8</td>
<td>0.27</td>
</tr>
<tr>
<td>13</td>
<td><em>Mentha longifolia</em> (L.) Huds. subsp. typhoides (Briq.) Harley AKUH 2711</td>
<td>Lamiaceae</td>
<td>Yarpuz</td>
<td>Aerial organs</td>
<td>Decoction as soup and oils are applied to the pain region</td>
<td>Body resistance, vitamin, respiratory diseases; leaf; infusion as tea.</td>
<td>36.6</td>
<td>5</td>
<td>0.16</td>
</tr>
<tr>
<td>14</td>
<td><em>Rosa damascena</em> Mill. AKUH 2754</td>
<td>Rosaceae</td>
<td>Gül</td>
<td>Flower</td>
<td>Flower oil is applied to the pain region.</td>
<td>Kidney, diuretic, flower; infusion as tea.</td>
<td>36.6</td>
<td>16</td>
<td>0.53</td>
</tr>
<tr>
<td>15</td>
<td><em>Melissa officinalis</em> L. subsp. officinalis L. AKUH 2742</td>
<td>Lamiaceae</td>
<td>Oğul otu</td>
<td>Leaf</td>
<td>Decoction as tea and oils are applied to the pain region</td>
<td>Sedative; leaf; decoction as tea.</td>
<td>36.6</td>
<td>5</td>
<td>0.16</td>
</tr>
<tr>
<td>16</td>
<td><em>Thymus vulgaris</em> L.*</td>
<td>Lamiaceae</td>
<td>Kekik</td>
<td>Leaf</td>
<td>Leaf oil is applied to the pain region.</td>
<td>Heart and vascular diseases; flower; infusion as tea.</td>
<td>36.6</td>
<td>10</td>
<td>0.33</td>
</tr>
</tbody>
</table>

(contd.)
Table 1—A list of taxa used for the MRSA pathogens

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Botanical name/Voucher number</th>
<th>Family</th>
<th>Local name</th>
<th>Parts used</th>
<th>Preparation and Administration</th>
<th>Other medicinal uses; parts used; administration (in the study area)</th>
<th>Fidelity level (Ip/Iu x100)</th>
<th>ΣUi UV</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td><em>Eucalyptus camaldulensis</em> Dehnh.*</td>
<td>Myrtaceae</td>
<td>Ökaliptus</td>
<td>Leaf</td>
<td>Decoction as tea.</td>
<td>-</td>
<td>36.6</td>
<td>5</td>
</tr>
<tr>
<td>18</td>
<td><em>Punica granatum</em> L. *</td>
<td>Lythraceae</td>
<td>Nar</td>
<td>Bush</td>
<td>Decoction as tea and Juice is done from leaves.</td>
<td>Diabetes; fruit juice; pressing.</td>
<td>36.6</td>
<td>5</td>
</tr>
<tr>
<td>19</td>
<td><em>Pinus nigra</em> Arn. subsp. <em>pallasiana</em> (Lamb.) Holmboe var. <em>pallasiana</em> AKUH 1683</td>
<td>Pinaceae</td>
<td>Katran ağacı</td>
<td>Stem</td>
<td>Stem portions at 300 ° C is burned. tar is obtained and applied to the wound with resin.</td>
<td>Infection, hemorrhoids; fruit; infusion.</td>
<td>36.6</td>
<td>9</td>
</tr>
<tr>
<td>20</td>
<td><em>Cedrus libani</em> A.Rich. AKUH 1696</td>
<td>Pinaceae</td>
<td>Katran ağacı</td>
<td>Stem</td>
<td>Stem portions at 300 ° C is burned. tar is obtained and applied to the wound with resin.</td>
<td>Peptic ulcers; abdominal pain; branches; decoction.</td>
<td>36.6</td>
<td>9</td>
</tr>
<tr>
<td>21</td>
<td><em>Quercus infectoria</em> Oliv. subsp. <em>infectoria</em> AKUH 1679 (*); Cultivated plants</td>
<td>Fagaceae</td>
<td>Mazı meşe</td>
<td>Galls</td>
<td>Decoction as tea.</td>
<td>Infection, hemorrhoids; fruit; infusion.</td>
<td>36.6</td>
<td>4</td>
</tr>
</tbody>
</table>

Fig. 3—The most common families in terms of species richness

family name, local name, used plant parts and their administration types. The UV of the plant taxa in this research is also given in Table 1. Additionally where Ip is the number of informants who independently indicated the use of a species for the MRSA ailment and Lu the total number of informants who mentioned the plant for any major ailment (Table 1).

Our results indicated that 4 species belongs to Lamiaceae, two species belong to Pinaceae and Asteraceae, and 1 species belongs to other families were used in treating MRSA by the locals (Fig. 3). For medical purposes: leaves were being used for 9 different purposes and this was followed by other plant parts as following; flowers 5, aerial organs 2, and root, fruit, bush and gal for one (Table 1). We found that the most commonly used parts of plants are leaves, flowers, aerial parts, fruits, root, bush and gal. These findings were in agreement with previous studies conducted in different parts of the world, where the leaves are cited as commonly used parts of the medicinal plants. The reason why leaves were mostly used is that they are collected very easily when compared to underground parts, flower and fruits, etc. Moreover, leaves are organs that actively photosynthesize, as well as metabolic activity, from a scientific point of view. Therefore, the locals’ activities can be monitored almost all the year round, gathering easily and utilizing them effectively much more than other plant parts. Utilisation types by the locals are decoction, infusion, application of tar extracted from plants using a special stone called “elcik” (Fig. 4A) to relevant body regions and

Fig. 4—A-Plant-crushed stones called as “elcik”, B-The application tar and mastic
application to body areas with abscess and discharge with the aid of a sterile cloth after mixing tar from prickly cedar or cade juniper with mastic (Table 1, Fig. 4B). The other preparation methods including direct consumption are syrup, mash, tar, mixture, aerial parts boiled, lotion, meal, swallow, fruits, gum, leaves eaten raw, frankincense and oil extracted. One of the results we have accomplished in the study area indicates that wild plants are more used and curative than cultivated plants. The ailments of gastrointestinal diseases, analgesic, kidney problems, coughs, diabetes, colds, stomachache, diuretic, asthma, allergic, blood pressure, vitamin C, bronchitis, cancer, blood-forming etc. are used for the treatments as allergic, blood pressure, vitamin C, bronchitis, cancer, blood-forming etc. are used for the treatments as mostly preferable (Table 1).

One of the purposes of using the medicinal plants were compared with the relevant papers in Turkey, and strong suitability was observed in terms of the ethnobotanical usage10-13, 18.

Statistical data analysis

UV and FL data analysis

UV scores were calculated from the use reports expressed by the rural people about the healing of the different diseases. These UV were found to be higher in case of some important medicinal species, which could be attributed to the trend of utilization of herbal drugs in the region19. The calculated UV in this study ranges from 0.06 to 0.53 which demonstrates from the least relative importance with Helichrysum italicum to the highest importance with Rosa damascene. For infectious diseases MRSA were categorized FL value. The highest FL was for Matricaria chamomilla var. recutita (90%), Camellia sinensis (80%), Olea europaea (76.6%) while the lowest FL appeared in the results Eryngium thorifolium, Thymelaea passerine, Althaea officinalis, Mentha longifolia subsp. typhoides etc. (36.6%) (Table 1). Khan et al.19, informants for being used against a given ailment. It shows the percentage of informants claiming the use of a certain plant species for the same major purpose19.

Discussion

Matricaria recutita, German chamomile, is best known with its anxiolytic and sedative properties. It is generally used for rashes, acne, dermatitis and eyewash. It has in general been reported from Italy that decoction is used for the treatment of eye inflammation and infection20. It is also used to promote wound healing related to MRSA21. Our current study indicates that it is used by patients with MRSA and helpful in healing the wound. Particular flower parts of plant are prepared with the decoction method and it is credited with being beneficial through the ingestion of its juice. Marrubium vulgare can be used in animals and humans in an effort to treat various diseases, including dermatitis, athlete’s foot, carbuncle, abscess, cyst and papilloma after boiling its aerial organs. It has been highlighted that phytochemical components of this plant have an anti-MRSA potential and will be able to be promising for patients with MRSA in the future6. People, who were infected with MRSA germ, stated that they used this plant and felt well during our study period. Anti-Staphylococcal properties of Hypericum species are well-known and they are probably considered to be appropriate for conventional therapies32. It is indicated that it was used by patients who contracted an infection in the hospital and caught illnesses such as osteomyelitis and were helpful for them in Afyonkarahisar. It is quoted to be effective especially when they consume 1 to 2 cup(s) a day with the infusion method. It is noted that Olea europaea is helpful when drinking 1 to 2 spoon(s) a day by extracting the oil from its fruit portions in Western Anatolia and that it is effective against microbe and promotes their recovery when used by patients who carry MRSA-germs. Furthermore, locals in the study area indicate that their ancestors used olive widely in the past for ethno botanical purposes, and it was effective in treating malaria and fever, and its curative aspect was powerful. Locals have reported that Plantago lanceolata has different traditional medical aspects, that they used this medicinal plant in respiratory diseases, and that its extract exhibits antibacterial activity against S. aureus and Bacillus subtilis. They believe that the diseases have not progressed when patients with chronic MRSA eat this herb. It has been reported that it was diuretic, homeostatic and active against tuberculosis when the leaves of Equisetum arvense were consumed by locals from past to present with the infusion method and it was helpful in tonsillitis, oral cavity and gingival bleeding and inflammations when gargled. It is indicated that leaves of Camellia sinensis are consumed by communities with the infusion method and it has an important effect on the treatment of MRSA. Abascal & Yarnell23 reports that this medicinal herb provided considerable potential benefits for antimicrobial activity against various pathogenic microorganisms, including methicillin-resistant Staphylococcus aureus, and acted
synergistically when used in combination with β-lactam antibiotics. In the study of Ökmen et al., methanol and ethanol root extracts of Cyclamen mirabile were scanned for the antimicrobial activity against 8 test organisms. It was determined the zone of inhibition 12 mm from the ethanol extract while zone of inhibition 11 mm was obtained from the methanol extract against Staphylococcus aureus. It is expected that this plant will be able to be highly effective against potential pathogens. It has been expressed that this herb palliated the disease when its leaf parts were eaten or tea by decoction method drunk against such pathogens in the district. It has been reported that it was beneficial to the disorder when Eryngium thorifolium was consumed by patients carrying the MRSA-germs in the region with the method of infusion. In the study of Kürek, Eryngium thorifolium showed the most obvious antimicrobial activity against tested-microorganisms. Extracts from Eryngium thorifolium caused the formation of zones of inhibition 14-19 mm in diameter on the MRSA hospital isolates. It was observed the values close to diameters of the inhibition zone of teikopil (≥14 mm sensitive) and vancomycin (≥15 mm sensitive) from the standard antibiotic discs that are used as control. It was observed that the hospital isolates of S. aureus ATCC 25923 strain (≥16 mm moderately-sensitive) and S. aureus (≥15 mm moderately-sensitive) have a weak antimicrobial activity. Nostro et al. revealed that diethyl ether extracts of Helichrysum italicum inhibit the growth of S. aureus (ATCC 6538P, MRSA and MSSA isolates) and some of its enzymes (coagulase, DNase, thermonuclease and lipase). They indicate that it reduced their chronic infections when patients with MRSA in Afyonkarahisar consumed this herb with the infusion method. In the study of Gökbulut et al., Thymelaea passerina was pulverized (20 gm) and was extracted from the powder obtained with petroleum ether, n-hexane, ethyl acetate and methanol in Soxhlet apparatus for one day separately. Then, dense extracts were prepared in order to use in microbiological studies by evaporating the solvents in the rotavapor. Extracts prepared with hexane and petroleum ether have only an effect on methicillin-resistant Staphylococcus aureus. Althaea officinalis, Mentha longifolia, Melissa officinalis subsp. officinalis and Rosa damascene are used in modern medicine to treat many diseases of microbial and non-microbial origin. Ethanol and hot-water extracts were evaluated for the potential antimicrobial activity against methicillin-resistant Staphylococcus aureus and water and ethanol extracts had an effect upon MRSA. Ethanol combination from plant extracts studied showed a synergistic antibacterial activity against MRSA strains. Talib & Mahasneh stressed that Rosa damascene may be effective against MRSA. Tohidpo et al. examined antibacterial aspect of Thymus vulgaris, detected oils with antibacterial activity and proposed an additional option of treating MRSA infections. Anderson et al. indicate that phytochemical extracts such as tea tree oil showed a strong in vitro antibacterial activity against MRSA. It has also been mentioned the activities of the tea plant against pathogens. Similarly, orthopedic surgeons stated that tea tree oil is effective in treating the methicillin-resistant Staphylococcus aureus infections. People in the regions have used against infections contracted in the hospital using the method of infusion after drying the brush part of Punica granatum. Its ethanolic and aqueous extract exhibit the best antibacterial activity against micro-organisms tested. It is used wood parts of the Pinus nigra subsp. pallasiana var. pallasiana and Cedrus libani, resinous wood of trees being old and rich in resin and with a thick trunk. Tar is formed at a temperature of 300 °C. Discharge and abscess are emptied out and patient recovers from the abscess when this tar is applied to patients with MRSA, discharge and abscess. This application can be irritating to the skin. It should be recommended that this product is used in 10 sessions by taking three days break because it even constricts the skin. Galls of Quercus infectoria subsp. infectoria are used in different medical disorders. It is used in especially postpartum applications and in diarrhea, bleeding, blood loss and skin diseases. In addition, some studies have revealed that gall structures have antibacterial activities. Its anti-MRSA, antiviral, antifungal and antioxidant features are highlighted. It was reported that gall of Quercus infectoria was effective against MRSA when used in combination with vancomycin antibiotics. Other medical areas of usage are also available in Turkey and the world, as well as using other species against MRSA. For example, powdered bark of Punica granatum is used in vaginal functions, skin allergies, acne, dysentery and infections of reproductive organs and otitis media. Hypericum perforatum is used as antidepressant in Germany and USA; Olea europaea is used as blood flow regulator by lowering the blood
pressure in the arteries and has a good antimicrobial activity against *Helicobacter pylori*; *Plantago lanceolata* is used in gastro-intestinal disorders, diarrhea and cough; *Equisetum arvense* has positive effects on diuresis, and shows antinociceptive and anti-inflammatory effects; *Camellia sinensis* has diuretic and central nervous system stimulant; *Cyclamen mirabile* has antibacterial activity; *Helichrysum italicum* has anti-inflammatory (pain-regulator) effects and is effective against eczema; the genus *Eryngium* is effective against edema, sinusitis, urinary tract infections, snake and scorpion bites and goiter, and its leaves are effective against infertility; *Thymelae passerine* has antimicrobial and diuretic effects and is effective against enteritis (intestinal inflammation) and stomach disorders; *Rosa longifolia* is effective against antinausea; *Rosa damascena* has anti-inflammatory, analgesic, hypnotic, muscle relaxant, anti-inflammatory and anticonvulsant effects; *Thymus vulgaris* is effective against acne, antiseptic, carminative; *Pinus nigra* subsp. *pallasiana* and its particular tar is against skin diseases and have antifungal, skin softening, muscle relaxant and painkiller effects.

**Conclusion**

This study was carried out in Afyonkarahisar and its surroundings. 21 medicinal plant species belonging to 16 families are used by local people to treat many diseases and ailments. Ethnobotanical approach against MRSA has been shown. By drying and making infusions or decoctions of these plants, local people use them during the whole year. The study reports a different approach to cure MRSA is presented.

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**References**


