Antibacterial activity of 50 medicinal plants used in folk medicine

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Key words: Antibacterial activity, medicinal plants, folk medicine.

doi: http://dx.doi.org/10.12692/ijb/3.4.104-121 Article published on April 22, 2013

Abstract

Emergence of bacterial resistance is critically an alarming situation in the health care industry. The bacterial resistance getting more serious and effort of developing new drugs initiated. Researchers from different part of the world extensively involved in the research. One of the method they employed is using the medicinal plants. These medicinal plants were used in the folk medicine to treat the illness. In previous time, the medicinal plants were just employed as a treatment without knowing the active compound/s which responsible to cure the disease. Most of the research done were based on the belief in traditional medicine and after the research done many researchers had concluded that the practice in the earlier time using the medicinal plants were right and having activities to overcome certain illness example involving bacterial illness. Some researchers proved that usage of medicinal plants in earliest time revealing negative results. In this review, all 50 medicinal plants were used in folk medicine and the modern research proved that the plants were having antibacterial property as claimed by in earliest time. Further research using the medicinal plants are needed to overcome the emergence of the bacterial resistance. To date synergistic study are very limited and it should be conducted so that any synergistic activities may reverse the bacterial resistance.

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Introduction

Medicinal plants according to World Health Organization (WHO) defines as herbal preparations made by introducing plant materials to extraction, fractionation, purification, concentration, or other physical or biological processes which may be produced for basis for herbal product or for the immediate consumption (Alo et al., 2012).

Plants are rich in nutrients and they are the main source of food. Plants are also rich in compounds which have pain relieving and healing abilities. From earliest times itself, without the knowledge about the compounds present in the plants and their mode of action, plants were used for the treatment of disease. Over the centuries societies around the world have developed their own tradition to make sense of medicinal plants and their uses. The wide spread use of herbal remedies and health care preparations gained from ordinarily used traditional herbs and medicinal plants have been elevated due to the occurrence of natural products with medicinal properties (Tiwari et al., 2011).

Herb widely used by more and more people looking for drugs and health approaches free from side effects caused by synthetic chemicals. More recently, attention has been paid to using eco-friendly products and plant-friendly formulation to prevent and cure different diseases of man. According to the records, 80% of the world population have loyalty in traditional medicine, especially plant-based drugs for their primary health care (Sivananthan and Elamaran, 2013).

Medicinal plants are important source for the confirmation of pharmacological properties and can be natural composite sources that act as new agent of anti-infectious. For the medicinal purposes different plant parts are used example bulb, gel, leaves, roots, barks, peels (Naz et al., 2010). No plant that can be categories as does not have medicinal value. The active components are usually extracted from all plant structures, but the amount of these components are vary from structure to structure. Highest amount of active principle within the part are preferred to therapeutic purposes (Anibijuwon and Udeze, 2009).

The usage of plants in treating the illness is found throughout human culture. The nonstop evolution of bacterial resistance to antibiotics that available in latest time has necessitated the search for novel and effective antimicrobial compounds. For antibacterial, antifungal and antiviral activities, globally, the extract of plant is used. Medicinal properties of more than 400,000 species of tropical flowering plants have been known. Due to this reasons, traditional medicine cheaper when compare to modern medicine (Naz et al., 2010).

The bacterial resistance to the antibiotics has created huge problems in healthcare industry. Fundamentally, there are three ways bacterial resistances can occurs that are preventing the drug from reaching its target, target alteration and antibiotics inactivation (Sivananthan and Elamaran, 2013). In general, bacteria have the genetic capability to communicate and obtain resistance to drugs, which are used as therapeutic agents. Bacterial resistance is a fact where concern need to be given because of the number of patients in hospitals with suppressed immunity, and due to new bacterial strains, which are multi-resistant. Consequently, new infections occur in hospitals which is causing in high mortality (Tiwari et al., 2011).

Some of the active compound individually or in combination hinder greatly the life processes of microbes, especially the microbes which are known as disease causing ones. They can achieve this by binding their protein molecules, acting as chelating agents (selective binding polyvalent metal ions so that the latter loses its biological activities), altering their biochemical systems, preventing utilization of available interests to the microorganisms, other causes inflammation analysis of microbial cells (Anibijuwon and Udeze, 2009).
In the table 1, the review of antibacterial property of different parts of the medicinal plants were stated. In this review, antibacterial property were narrowly reviewed. All 50 medicinal plants were possessing antibacterial property and this review proved the practice of using medicinal plants in earliest time to treat illness.

Table 1. Antibacterial medicinal plants.

<table>
<thead>
<tr>
<th>No</th>
<th>Plant name</th>
<th>Parts used</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Andrographis paniculata</td>
<td>Leaves</td>
<td>Hosamani et al., 2011; Kumar et al., 2010; Sivananthan and Elamaran, 2013; Sahalan et al., 2007.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Root</td>
<td>Radhika and Lakshmi, 2010; Sivananthan and Elamaran, 2013</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Stem</td>
<td>Radhika and Lakshmi, 2010</td>
</tr>
<tr>
<td>2</td>
<td>Psidium guajava</td>
<td>Leaves</td>
<td>Sivananthan and Elamaran, 2013; Sanches et al., 2005; Metwally et al., 2010; Dhiman et al., 2011; Pandey and Shweta, 2012; Chanda and Nair, 2007.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Root</td>
<td>Sanches et al., 2005</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Stem</td>
<td>Sanches et al., 2005; Esimone et al., 2011; Pandey and Shweta, 2012</td>
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<tr>
<td></td>
<td></td>
<td>Fruit</td>
<td>Pandey and Shweta, 2012</td>
</tr>
<tr>
<td>3</td>
<td>Durio zibethinus</td>
<td>Wood bark</td>
<td>Sivananthan and Elamaran, 2013</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fruit</td>
<td>Lipipun et al., 2002</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Seed</td>
<td>Duazo et al., 2012</td>
</tr>
<tr>
<td>5</td>
<td>Azadirachta indica</td>
<td>Flower</td>
<td>Aromdee and Sruibolmas, 2006</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Leaves</td>
<td>Maragathavalli et al., 2012; Lakshmi and Kumar, 2012; Reddy et al., 2012.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Root</td>
<td>Manogaran et al., 1998</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Seed</td>
<td>Mandal et al., 2007</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bark</td>
<td>Reddy et al., 2012; Manogaran et al., 1998</td>
</tr>
<tr>
<td>6</td>
<td>Acalypha indica</td>
<td>Leaves</td>
<td>Govindarajan et al., 2008; Mohan et al., 2012; Rajaselvan et al., 2012; Somchit et al., 2010; Krishnaraj et al., 2010; Chitravadivu et al., 2009; Devi et al., 2009.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Root</td>
<td>Chitravadivu et al., 2009</td>
</tr>
<tr>
<td>7</td>
<td>Allium sativum</td>
<td>Clove</td>
<td>Saravanan et al., 2010; Deresse, 2010; Yousufi, 2012; Meenakshi et al., 2008; Nahor and Ahmed, 2012.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Leaves</td>
<td>Meenakshi et al., 2008</td>
</tr>
<tr>
<td>8</td>
<td>Allium cepa</td>
<td>Leaves</td>
<td>Nath et al., 2010.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bulbs</td>
<td>Adesinha et al., 2011; Grover et al., 2011; Penecilla and Magno, 2011.</td>
</tr>
<tr>
<td>9</td>
<td>Aloe vera</td>
<td>Leaves</td>
<td>Alamdar and Agaoglu, 2009; Kedarnath et al., 2012; Molla et al., 2010</td>
</tr>
<tr>
<td>10</td>
<td>Piper betle</td>
<td>Leaves</td>
<td>Hoque et al., 2011</td>
</tr>
<tr>
<td>11</td>
<td>Emblica officinalis</td>
<td>Seed</td>
<td>Priya et al., 2012</td>
</tr>
</tbody>
</table>
| Species                        | Part       | Sources                                                                 |\hline
| Coriandrum sativum            | Fruits     | Patil et al., 2012; Aneja et al., 2010; Hossain et al., 2012.           |\hline
|                               | Leaves     | Nain et al., 2012                                                        |\hline
| Saraca indica                 | Leaves     | Reddy et al., 2012; Cao et al., 2012.                                    |\hline
|                               | Fruits     | Cantore et al., 2004.                                                    |\hline
| Withania Somnifera            | Root       | Jain and Varshney, 2011; Owais et al., 2005; Mehrotra et al., 2011.     |\hline
|                               | Leaves     | Owais et al., 2005.                                                      |\hline
| Aegle marmelos                | Leaves     | Jyothi and Rao, 2010; Poonkothai and Saravanan, 2008; Kothari et al., 2011. |\hline
| Phyllanthus amarus            | Leaves     | Akinjogunla et al., 2010; Okolo et al., 2012; Dhandapani et al., 2007. |\hline
|                               | Root       | Akinjogunla et al., 2010; Okolo et al., 2012.                           |\hline
|                               | Stem       | Okolo et al., 2012                                                       |\hline
|                               | Seeds      | Okolo et al., 2012                                                       |\hline
| Swertia chirata               | Leaves     | Alam et al., 2009.                                                       |\hline
|                               | Stem       | Alam et al., 2009.                                                       |\hline
| Gymnema Sylvestre             | Leaves     | Satdive et al., 2003; Khanna and Kannabiran, 2008; Sinha et al., 2010.  |\hline
| Commiphora Wightii            | Gum        | Ishnava et al., 2010; Goyal et al., 2010;                                |\hline
|                               | Stem       | Nair and Chanda, 2007                                                    |\hline
|                               | Leaves     | Nair and Chanda, 2004                                                    |\hline
| Tinospora Cordifolia          | Stem       | Jeyachandran et al., 2003; Verma and Kakkar, 2011; Singh and Singh, 2012; Tambekar et al., 2009. |\hline
|                               | Roots      | Rose et al., 2010.                                                       |\hline
| Gloriosa superba              | Leaves     | Banu and Nagarajan, 2011.                                                |\hline
|                               | Tuber      | Banu and Nagarajan, 2011; Megala and Elango, 2012; Senthilkumar, 2013   |\hline
|                               | Seeds      | Megala and Elango, 2012; Senthilkumar, 2013.                             |\hline
| Piper longum                  | Fruits     | Sampath et al., 2012; Joy et al., 2010.                                  |\hline
|                               | Roots      | Sampath et al., 2012; Ali et al., 2007; Naika et al., 2010.              |\hline
|                               | Stems      | Ali et al., 2007.                                                        |\hline
|                               | Leaves     | Ali et al., 2007.                                                        |\hline
| Solanum nigrum                | Leaves     | Zubair et al., 2011; Yogananth et al., 2012.                             |\hline
|                               | Fruits     | Karmakar et al., 2010; Kaushik et al., 2009.                             |\hline
| Coleus forskohilii            | Roots      | Saklani et al., 2011                                                    |\hline
|                               | Leaves     | Senthilkumar et al., 2010                                                 |\hline
| Santalum Album                | Leaves     | Kumar et al., 2006; Bakkhiyaraj and Pandiyaraj, 2011.                    |\hline
|                               | Stem       | Kumar et al., 2006.                                                      |\hline
| Rauwolfia Serpentina          | Leaves     | Ahmed et al., 2002                                                       |\hline
|                               | Roots      | Ahmed et al., 2002; Harisaranraj et al., 2010.                           |\hline
| Asparagus Racemosus           | Roots      | Mandal et al., 2000; Sinha and Biswas, 2011; Ravishankar et al., 2012; Uddin et al., 2012. |\hline
| Cassia augustifolia           | Leaves     | Gnanavel et al., 2012; Sood et al., 2012.                                |\hline
|                               | Roots      | Mahalingam et al., 2011                                                   |\hline
| Cassia Fistula                | Leaves     | Awal et al., 2010                                                        |\hline
|                               | Roots      | Awal et al., 2010                                                        |\hline
|                               | Seeds      | Lachumy et al., 2010                                                     |\hline
<table>
<thead>
<tr>
<th>Plant Name</th>
<th>Part</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ocimum sancum</td>
<td>Leaves</td>
<td>Mahmood et al., 2008; Baskaran, 2008; Mishra and Mishra, 2011; Goyal and Kaushik, 2011; Sundaramurthi et al., 2012.</td>
</tr>
<tr>
<td>Embelia Ribes</td>
<td>Fruits</td>
<td>Khan et al., 2010</td>
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<tr>
<td></td>
<td>Seeds</td>
<td>Tambekar et al., 2009</td>
</tr>
<tr>
<td>Mentha piperita</td>
<td>Leaves</td>
<td>Bapesh et al., 2007; Saeed and Tariq, 2005; Priya et al., 2007; Pramila et al., 2012.</td>
</tr>
<tr>
<td></td>
<td>Stem</td>
<td>Saeed and Tariq, 2005.</td>
</tr>
<tr>
<td>Lawsonia inermis</td>
<td>Leaves</td>
<td>Malekzadeh, 1968; Sarojini et al., 2012; Habbel et al., 2005; Mastanaiah et al., 2011.</td>
</tr>
<tr>
<td></td>
<td>Seeds</td>
<td>Habbel et al., 2005.</td>
</tr>
<tr>
<td>Eclipta alba</td>
<td>Leaves</td>
<td>Sharma and Sharma, 2010; Dalal et al., 2010; Sandhu et al., 2012; Raut et al., 2012; Ropa et al., 2012.</td>
</tr>
<tr>
<td></td>
<td>Stem</td>
<td>Sandhu et al., 2012; Raut et al., 2012</td>
</tr>
<tr>
<td></td>
<td>Flowers</td>
<td>Sandhu et al., 2012.</td>
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<tr>
<td></td>
<td>Roots</td>
<td>Raut et al., 2012.</td>
</tr>
<tr>
<td>Plumbago Zeylanica</td>
<td>Roots</td>
<td>Jeyachandran et al., 2009; Jetty et al., 2009; Lemma et al., 2002; Rahman and Anvar, 2007.</td>
</tr>
<tr>
<td></td>
<td>Leaves</td>
<td>Devi and Thenmozhi, 2011; Ravikumar and Sudha, 2011.</td>
</tr>
<tr>
<td></td>
<td>Stem</td>
<td>Ravikumar and Sudha, 2011.</td>
</tr>
<tr>
<td>Terminalia Chebula</td>
<td>Fruits</td>
<td>Kannan et al., 2009; Hogade et al., 2011; Singh and Kumar, 2012; Tariq and Reyaz, 2012.</td>
</tr>
<tr>
<td></td>
<td>Leaves</td>
<td>Singh and Kumar, 2012.</td>
</tr>
<tr>
<td></td>
<td>Stem</td>
<td>Singh and Kumar, 2012.</td>
</tr>
<tr>
<td></td>
<td>Stem bark</td>
<td>Singh and Kumar, 2012.</td>
</tr>
<tr>
<td>Tribulus Terrestris</td>
<td>Leaves</td>
<td>Al-Bayati and Al-Mola, 2008; Usman et al., 2007.</td>
</tr>
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<td>Hemidesmus Indicus</td>
<td>Roots</td>
<td>Gayathri and Kannabiran, 2009; Subba et al., 2012.</td>
</tr>
<tr>
<td>Acorus Calamus</td>
<td>Rhizomes</td>
<td>Devi and Ganjewala, 2009; Phongpaichit et al., 2005; Manikandan et al., 2010.</td>
</tr>
<tr>
<td>Mesua Ferrea</td>
<td>Flower</td>
<td>Mazumder et al., 2004.</td>
</tr>
<tr>
<td>Vettiveria zizanioides</td>
<td>Roots</td>
<td>Subba et al., 2012; Luqman et al., 2005; Sangeetha and Stella, 2012; Putiyanan et al., 2005; Barad et al., 2013.</td>
</tr>
<tr>
<td></td>
<td>Leaves</td>
<td>Sangeetha and Stella, 2012.</td>
</tr>
<tr>
<td>Centella asiatica</td>
<td>Leaves</td>
<td>Taemchuy et al., 2009; Rishikesh et al., 2012; Sekar et al., 2011.</td>
</tr>
<tr>
<td></td>
<td>Roots</td>
<td>Murugan and Mohan, 2011.</td>
</tr>
<tr>
<td></td>
<td>Seeds</td>
<td>Murugan and Mohan, 2011; Kumar et al., 2009; Vikran et al., 2013.</td>
</tr>
<tr>
<td>Cinnamomum Zeylanicum</td>
<td>Bark</td>
<td>Gende et al., 2008; Ulu et al., 2010; Nimje et al., 2013.</td>
</tr>
<tr>
<td></td>
<td>Leaves</td>
<td>Boniface et al., 2012.</td>
</tr>
<tr>
<td>Solanum Xanthocarpum</td>
<td>Leaves</td>
<td>Udayakumar et al., 2003.</td>
</tr>
<tr>
<td></td>
<td>Stem</td>
<td>Udayakumar et al., 2003.</td>
</tr>
<tr>
<td></td>
<td>Roots</td>
<td>Udayakumar et al., 2003.</td>
</tr>
<tr>
<td>Zingiber officinale</td>
<td>Rhizomes</td>
<td>Gull et al., 2012; Auta et al., 2011; Sasidharan</td>
</tr>
</tbody>
</table>
Conclusion
This review was done to collect the information of 50 medicinal plants which are having the antibacterial property. Previously these 50 medicinal plants which were discussed in this review, were extensively included in the research by many researchers from different parts of the world. They had made conclusion that these 50 medicinal plants were having good antibacterial property. From this precious findings by researchers, in future the studies involving the medicinal plants need to be focused narrowly more on overcoming the bacterial resistance like combining synthetic drugs and compound from medicinal plants to produce synergistic activities which is much more appreciable where novel drugs can be invented to reverse such bacterial resistance. To date the synergistic studies are very limited with researchers are not extensively involved.

Acknowledgement
I would like to thank to Elamaran Manoharan, Faculty of Pre University, Mahmud High School, Jalan Tras, Raub, Pahang, Malaysia.

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