INNSPUB

International Journal of Biosciences | IJB |
ISSN: 2220-6655 (Print) 2222-5234 (Online)
http://www.innspub.net
Vol. 3, No. 4, p. 104-121, 2013

MINIREVIEW OPEN ACCESS

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.

No	Plant name	Parts used	References
1	*Andrographis paniculata*	Leaves	Hosamani *et al*, 2011; Kumar *et al*., 2010; Sivananthan and Elamaran, 2013; Sahalan *et al*., 2007.
		Root	Radhika and Lakshmi, 2010; Sivananthan and Elamaran, 2013
		Stem	Radhika and Lakshmi, 2010
2	*Psidium guajava*	Leaves	Sivananthan and Elamaran, 2013; Sanches *et al*., 2005; Metwally *et al*., 2010; Dhiman *et al*., 2011; Pandey and Shweta, 2012; Chanda and Nair, 2007.
		Root	Sanches *et al*., 2005
		Stem	Sanches *et al*., 2005; Esimone *et al*., 2011; Pandey and Shweta, 2012
		Fruit	Pandey and Shweta, 2012
3	*Durio zibethinus*	Wood bark	Sivananthan and Elamaran, 2013
		Fruit	Lipipun *et al*., 2002
		Seed	Duazo *et al*., 2012
4	*Adhatoda vasica*	Leaves	Sheeba and Mohan, 2012; Karthikeyan *et al*., 2010; Kathale, 2013; Kaur *et al*, 2012.
5	*Azadirachta indica*	Flower	Aromdee and Sriubolmas, 2006
		Leaves	Maragathavalli *et al*., 2012; Lakshmi and Kumar, 2012; Reddy *et al*., 2012.
		Root	Manogaran *et al*., 1998.
		Seed	Mandal *et al*., 2007
		Bark	Reddy *et al*., 2012; Manogaran *et al*., 1998.
6	*Acalypha indica*	Leaves	Govindarajan *et al*., 2008; Mohan *et al*., 2012; Rajaselvam *et al*., 2012; Somchit *et al*., 2010; Krishnaraj *et al*., 2010; Chitravadivu *et al*., 2009; Devi *et al*., 2009.
		Root	Chitravadivu *et al*., 2009.
7	*Allium sativum*	Clove	Saravanan *et al*., 2010; Deresse, 2010; Yousufi, 2012; Meenakshi *et al*., 2008; Nahor and Ahmed, 2012.
		Leaves	Meenakshi *et al*., 2008.
8	*Allium cepa*	Leaves	Nath *et al*., 2010.
		Bulbs	Adeshina *et al*., 2011; Grover *et al*., 2011; Penecilla and Magno, 2011.
9	*Aloe vera*	Leaves	Alamdar and Agaoglu, 2009; Kedarnath *et al*., 2012; Molla *et al*.,2010
10	*Piper betle*	Leaves	Hoque *et al*., 2011
11	*Emblica officinalis*	Seed	Priya *et al*., 2012.

		Fruits	Patil *et al.*, 2012; Aneja *et al.,* 2010; Hossain *et al.*, 2012.
		Leaves	Nain *et al.*, 2012
12	*Coriandrum sativum*	Leaves	Reddy *et al.*, 2012; Cao *et al.,* 2012.
		Fruits	Cantore *et al.*, 2004.
13	*Saraca indica*	Leaves	Nayak *et al.,* 2011; Sarojini *et al.,* 2011.
		Bark	Sainath *et al.*, 2009.
14	*Withania Somnifera*	Root	Jain and Varshney, 2011; Owais *et al.,* 2005. Mehrotra *et al.,* 2011.
		Leaves	Owais *et al.*, 2005.
15	*Aegle marmelos*	Leaves	Jyothi and Rao, 2010; Poonkothai and Saravanan, 2008; Kothari *et al.,* 2011.
		Bark	Poonkothai and Saravanan, 2008
16	*Phyllanthus amarus*	Leaves	Akinjogunla *et al.*, 2010; Okolo *et al.,* 2012; Dhandapani *et al.*, 2007.
		Root	Akinjogunla *et al.,* 2010; Okolo *et al.*, 2012.
		Stem	Okolo *et al.*, 2012
		Seeds	Okolo *et al.*, 2012
17	*Swertia Chirata*	Leaves	Alam *et al.,* 2009.
		Stem	Alam *et al.*, 2009.
18	*Gymnema Sylvestre*	Leaves	Satdive *et al.*, 2003; Khanna and Kannabiran, 2008; Sinha *et al.*, 2010.
19	*Commiphora Wightii*	Gum	Ishnava *et al.*, 2010; Goyal *et al.*, 2010;
		Stem	Nair and Chanda, 2007
		Leaves	Nair and Chanda, 2004.
20	*Tinospora Cordifolia*	Stem	Jeyachandran *et al.*, 2003; Verma and Kakkar, 2011; Singh and Singh, 2012; Tambekar *et al.,* 2009.
		Roots	Rose *et al.*, 2010.
21	*Gloriosa superba*	Leaves	Banu and Nagarajan, 2011.
		Tuber	Banu and Nagarajan, 2011; Megala and Elango, 2012; Senthilkumar, 2013
		Seeds	Megala and Elango, 2012; Senthilkumar, 2013.
22	*Piper longum*	Fruits	Sampath *et al.*, 2012; Joy *et al.,* 2010.
		Roots	Sampath *et al.*, 2012; Ali *et al.*, 2007; Naika *et al.,* 2010.
		Stems	Ali *et al.*, 2007.
		Leaves	Ali *et al.,* 2007.
23	*Solanum nigrum*	Leaves	Zubair *et al.*, 2011; Yogananth *et al.*, 2012.
		Fruits	Karmakar *et al.*, 2010; Kaushik *et al.*, 2009.
24	*Coleus forskohlii*	Roots	Saklani *et al.*, 2011
		Leaves	Senthilkumar *et al.*, 2010
25	*Santalum Album*	Leaves	Kumar *et al.*, 2006; Bakkiyaraj and Pandiyaraj, 2011.
		Stem	Kumar *et al.*, 2006.
26	*Rauwolfia Serpentina*	Leaves	Ahmed *et al.*, 2002
		Roots	Ahmed *et al.*, 2002; Harisaranraj *et al.*, 2010.
27	*Asparagus Racemosus*	Roots	Mandal *et al.*, 2000; Sinha and Biswas, 2011; Ravishankar *et al.*, 2012; Uddin *et al.*, 2012.
28	*Cassia augustifolia*	Leaves	Gnanavel *et al.*, 2012; Sood *et al.*, 2012.
		Roots	Mahalingam *et al.*, 2011
29	*Cassia Fistula*	Leaves	Awal *et al.*, 2010
		Roots	Awal *et al.*, 2010
		Seeds	Lachumy *et al.*, 2010.

30	*Ocimum sanclum*	Leaves	Mahmood *et al.*, 2008; Baskaran, 2008; Mishra and Mishra, 2011; Goyal and Kaushlk, 2011; Sundaramurthi *et al.*, 2012.
31	*Embelia Ribes*	Fruits	Khan *et al.*, 2010
		Seeds	Tambekar *et al.*, 2009
32	*Mentha piperita*	Leaves	Bupesh *et al.,* 2007; Saeed and Tariq, 2005; Priya *et al.,* 2007; Pramila *et al.*, 2012.
		Stem	Saeed and Tariq, 2005.
33	*Lawsonia inermis*	Leaves	Malekzadeh, 1968; Sarojini *et al.*, 2012; Habbal *et al.*, 2005; Mastanaiah *et al.,* 2011.
		Seeds	Habbal *et al.*, 2005.
34	*Eclipta alba*	Leaves	Sharma and sharma, 2010; Dalal *et al.,* 2010; Sandhu *et al.*, 2012; Raut *et al.*, 2012; Ripa *et al.*, 2012.
		Stem	Sandhu *et al.*, 2012; Raut *et al.*, 2012
		Flowers	Sandhu *et al.*, 2012.
		Roots	Raut *et al.*, 2012.
35	*Plumbago Zeylanica*	Roots	Jeyachandran *et al.*, 2009; Jetty *et al.*, 2009; Lemma *et al.*, 2002*;* Rahman and anwar, 2007.
		Leaves	Devi and Thenmozhi, 2011; Ravikumar and Sudha, 2011.
		Stem	Ravikumar and Sudha, 2011.
36	*Terminalia Chebula*	Fruits	Kannan *et al.*, 2009; Hogade *et al.*, 2011; Singh and kumar, 2012; Tariq and Reyaz, 2012.
		Leaves	Singh and kumar, 2012.
		Stem	Singh and kumar, 2012.
		Stem bark	Singh and kumar, 2012.
37	*Tribulus Terrestris*	Leaves	Al-Bayati and Al-Mola, 2008; Usman *et al.*, 2007.
		Roots	Al-Bayati and Al-Mola, 2008.
		Fruits	Al-Bayati and Al-Mola, 2008.
38	*Hemidesmus Indicus*	Roots	Gayathri and Kannabiran, 2009; Subha *et al*, 2012.
39	*Acorus Calamus*	Rhizomes	Devi and Ganjewala, 2009; Phongpaichit *et al.*, 2005; Manikandan *et al.*, 2010.
		Leaves	Devi and Ganjewala, 2009.
40	*Mesua Ferrea*	Flower	Mazumder *et al.*, 2004;
		Leaves	Keawsa-ard and Kongtaweelert, 2012; Mazumder *et al.*, 2003;
		Seeds	Rawat and Upadhyaya, 2013.
41	*Vetiveria zizanioides*	Roots	Subha *et al*, 2012; Luqman *et al.*, 2005; Sangeetha and Stella, 2012; Putiyanan *et al.*, 2005; Barad *et al.*, 2013.
		Leaves	Sangeetha and Stella, 2012.
42	*Centella asiatica*	Leaves	Taemchuay *et al.*, 2009; Rishikesh *et al.*, 2012; Sekar *et al.*, 2011.
43	*Mucuna pruriens*	Leaves	Salau and Odeleye, 2007.
		Roots	Murugan and Mohan, 2011.
		Seeds	Murugan and Mohan, 2011; Kumar *et al.*, 2009; Vikran *et al.*, 2013.
44	*Cinnamomum Zeylanicum*	Bark	Gende *et al.*, 2008; Unlu *et al.*, 2010; Nimje *et al.*, 2013.
		Leaves	Boniface *et al.*, 2012.
45	*Solanum Xanthocarpum*	Leaves	Udayakumar *et al.*, 2003.
		Stem	Udayakumar *et al.*, 2003.
		Roots	Udayakumar *et al.*, 2003.
46	*Zingiber officinale*	Rhizomes	Gull *et al.*, 2012; Auta *et al.*, 2011; Sasidharan

			and Menon, 2010.
47	*Gingko biloba*	Leaves	Sati and Joshi, 2011; Xie *et al.*, 2003; Tao *et al.*, 2013.
48	*Vitis vinifera*	Leaves	Katalinic *et al.*, 2013; Orhan *et al.*, 2009;
		Seeds	Adamez *et al.*, 2012.
49	*Equisetum arvense*	Stems	Radulovic *et al.*, 2006; Sinha, 2012.
50	*Calendula officinalis*	Petals	Efstratiou *et al.*, 2012
		Leaves	Rashmi and Goyal, 2011.
		Roots	Rashmi and Goyal, 2011; Tiwari *et al.*, 2011.
		Stems	Rashmi and Goyal, 2011.

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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