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A REVIEW: ANTI-OXIDANT AND ANTI-MICROBIAL ACTIVITY OF SELECTED PLANTS

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Abstract

The beneficial effect of medicinal plants generally derives from the secondary products found in the plant, although a mixture of the metabolites having multiples composites. The medicinal activity of plants is specific to a particular species or group of plants. A taxonomically distinct mixture of secondary metabolites exists within a particular plant. Plant screening typically requires many approaches; one of the common methods used to select the plant for pharmacological analysis. The antioxidant activity of medicinal plants is well known and utilized for several health benefits, including cardiovascular disease, cancer etc. The antioxidant and antimicrobial properties of different medicinal plants have been reviewed here.

Keywords*- Medicinal plants, Secondary metabolites, Antioxidant Activity***,** *Antimicrobial Activity*

INTRODUCTION

The climatic condition in India is suitable for the production of plant based medicinal drugs for the purpose of preventative and therapeutic interest (Škrovánková *et al.*, 2012). The various soil texture of India is ideal for growing aromatic and medicinal plants which can be use as raw materials for pharmaceutical, perfumery, cosmetics, flavoring and food and agrochemical industries (Sagbo and Mbeng ., 2018; Jamshidi-Kia *et al.*, 2018; Awuchi ., 2019). Various plants that grow in the wild are useful for exploitation, particularly for use in indigenous pharmaceutical houses. A number of these plants produce valuable drugs with export potential (Nair and Chanda, 2005).

Various forms of secondary metabolites are present in medicinal plants and its traditional knowledge play an important role in the treatment of many kinds of diseases such as respiratory disorder, asthma, skin diseases, tuberculosis etc (Dogra *et al.*, 2015; Yudharaj *et al.*, 2016; Salhi *et al.*, 2019; Sharifi-Rad *et al.*, 2020). Plants are also known to possess a wide range of additional characteristics such as antioxidants, anti-inflammatories, anti-parasites, antibiotics and anti-hemolytics, which are frequently utilized by tribal people across the world. (Bamola *et al.*, 2018).

The antioxidant activity of medicinal plants is widely recognized and used for a variety of health benefit, including decreasing blood pressure, avoiding cardiovascular disease, and lowering cancer risk. (Škrovánková *et al.*, 2012). The antimicrobial components from medicinal plant may inhibit the growth of bacteria, fungi, viruses, and protozoa by different mechanisms than those have a significant therapeutic value in treating resistant microbial strains (Shankar *et al.*, 2010; Vaou *et al.*, 2021).

Antioxidant assay

Antioxidants are compounds that inhibit and stabilize the damage incurred by free radicals by supplying antioxidants to these cells (Hamid *et al.*, 2010). Antioxidants also transform free radicals and unwanted by-products that are removed from the body. Consumption of antioxidant-rich fruit and vegetables is known to reduce the risk off certain diseases caused by free radicals (Rahman *et al.*, 2015).

Table 1: Antioxidant assay of selected medicinal plants

Sr. No.	Plant Name	Family	Plant parts	Solvent	Antioxidant Assay	References
1	*Adiantum capillus- veneris* L.	Adiantaceae	Whole plant	Ethanol	DPPH, FRAP, SASA	Jiang et al., 2011
2	*Azadirachta indica* Juss.	Meliaceae	Leaf	Ethanol	DPPH	Pandey *et al.*, 2014.

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3	*Baliospermum montanum* Muell-Arg	Euphorbiaceae	Roots	Aqueous	DPPH, NORSA, PFRAP	Desai *et al.*, 2008
4	*Boerhaavia diffusa* L.	Nyctaginaceae	Roots	Ethanol, Methanol	DPPH, FRAP, NORSA, PFRAP	Khalid *et al.*, 2012.
5	*Cassia auriculata* L.	Fabaceae	Flowers	Ethanol, Methanol	ABTS, DPPH	Kumaran and Karunakaran ., 2007
6	*Cassia fistula* Linn.	Caesalpiniaceae	Fruit, Seeds	Hexane, Methanol	DPPH, FRAP, PFRAP, HRSA	Irshad *et al.*, 2012
7	*Cotinus coggygria* Scop.	Anacardiaceae	Leaves	Methanol	DPPH, FTC, TBA	Karagöz *et al.*, 2015
8	*Crocus sativus* L.	Iridaceae	Sepals	Ethanol, Aqueous	D0DPH, ABTS	Kakouri *et al.*, 2017
9	*Curcuma longa* L.	Zingiberaceae	Rhizome	Petroleum ether	DPPH, FRAP, PMA	Bulus *et al.*, 2017
10	*Cymbopogon citrates* (DC.) Stapf	Gramineae	Aerial part, leaves	Methanol	DPPH, SASA	Cheel *et al.*, 2005
11	*Datura metel* L.	Solanaceae	Leaves	Hexane, Ethyl acetate, Chloroform Methanol	DPPH, HRSA , FRAP	Sangeetha *et al.*, 2014.
12	*Foeniculum vulgare* Mill	Apiaceae	Seed oil	Methanol	DPPH, PFRAP	Abdellaoui *et al.*,, 2017
13	*Kedrostis foetidissima* (Jacq.) Cogn.	Cucurbitaceae	Leaves	Aqueous, Methanol, Acetone, Chloroform, Petroleum Ether	DPPH, MCA, PFRAP, HRSA	Sasikumar and Kalaisezhiyen., 2014
14	*Momordica charantia* Linn. Var. abbreriata Ser.	Cucurbitaceae	Whole plant	Aqueous, Ethanol	DPPH , MCA , SICA, FRAP	Wu and Ng., 2008
15	*Murraya koenigii* L.	Rutaceae	Leaves	Methanol, Hydro alcohol, Aqueous	DPPH, HPSA, PFRAP, NORSA, HRSA, SRSA	Aju *et al.*, 2017
16	*Polyalthia cerasoides* (Roxb.) Bedd	Annonaceae	Stem bark	Ethanol	DPPH,HRSA, SASA ,FRAP	Ravikumar *et al.*, 2008
17	*Solanum tuberosum* L. var. vitelotte	Solanaceae	Tuber	Methanol, Ethanol, Acetone, Aqueous	DPPH, FRAP	Bontempo *et al* ., 2013
18	*Stevia rebaudiana* Bert.	Asteraceae	Leaves	Aqueous	DPPH, HRSA , NORSA, SASA	Shukla *et al.*, 2012
19	*Terminalia bellerica* Roxb.	Combretaceae	Fruit	Hexane, Chloroform, Ethyl acetate, Butanol , Aqueous	DPPH, SASA, H_2O_2, HRSA	Basu *et al.*, 2017
20	*Teucrium polium* L.	Lamiaceae	Aerial part	Petroleum ether,	DPPH, BBT, ATC	Sharififar *et al.*, 2009

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				Chloroform, Methanol, Aqueous		

Note:- SASA= Superoxide Anion Scavenging Assay; SICA= Superior Iron Chelating Activity; MCA= Metal chelating activity; FRAP= Free radical scavenging activity assay; HRSA= Hydroxyl Radical Scavenging Activity; BBT= Beta-carotene bleaching test; ATC= ammonium thiocyanate method, ABTS= 2,2-azinobis(3-ethylbenzthiazoline-6-acid) radical scavenging assay , PMA= Phosphomolybdate assay, H_2O_2= Hydrogen Peroxide Scavenging assay, NORSC= Nitric Oxide Radical Scavenging Activity

Anti-microbial assay

Antibacterial activity is the most important feature of medical textiles, offering sufficient protection against microorganisms, biological fluids, and aerosols, as well as disease transmission (Alihosseini., 2016). Antimicrobial activity are performed by various methods such as, agar well diffusion, dispersion, disc diffusion, agar disc diffusion and paper disc. In this assay, there are mainly two mechanisms, which include interfering chemically with the synthesis of vital components of bacteria and bypassing the conventional mechanisms of antibacterial resistance (Magiorakos *et al*.,2012; Velayati *et al*.,2009).

Table 2: Antimicrobial activity of selected plant

Sr. no	Plant name	Family	Plant parts	Solvent	Bacterial Strain	Antimicrobial Assay	References
1	*Achyranthes aspera* L. var. *aspera*	Amaranthaceae	Leaves	Methanol, Chloroform	*Staphylococcus aureus, Salmonella typhi, Escherichia coli, Pseudomonas aeruginosa and Shigella boydii*	Agar well diffusion	Habtamu & Mekonnen ., 2017
2	*Azadirachta indica* A. Juss	Meliaceae	Leaves	Hexane, Chloroform Methanol	*Escherichia, Klebsiella pneumonia, Proteus vulgaris, Micrococcus luteus, Bacillus subtilis, Enterococcus faecalis and Streptococcus faecalis*	Agar Well Diffusion	Koona and Budida ., 2011
3	*Betula utilis* D. Don	Betulaceae	Bark	Petroleum Ether, Chloroform, Methanol, Ethanol, Aqueous	*Escherichia coli, Klebsiella pneumonia, Proteus mirabilis, Pseudomonas aeruginosa, Salmonella paratyphi, Salmonella typhi, Salmonella typhimurium, Shigella flexneri, Shigella sonnei, Staphylococcus aureus, Streptococcus faecalis, Shigella boydii, Citrobacter sp.,Salmonella paratyphi B, Shigella boydii*	Agar well diffusion method	Kumaraswamy *et al*., 2008
4	*Derris robusta* (DC.) Benth.	Fabaceae	Leaves	Methanol	*Bacillus subtilis, Escherichia coli*	Disc diffusion assay	Paul *et al*., 2019
5	*Derris trifoliata* Lour.	Leguminosae	Seeds	Aqueous	*Escherichia coli , Klebsiella pneumoniae , Pseudomonas aeruginosa* and *Staphylococcus aureus*	Agar well diffusion	Arulmozhi *et al*., 2018

6	**1.** *Enicostemma axillare* (Poir. ex Lam.) A.Raynal	Gentianaceae	Leaves	Methanol, Chloroform Aqueous	*Escherichia coli Staphylococcus aureus, Pseudomonas aeruginosa*	Disc diffusion method, Minimum Inhibitory Concentration (MIC)	Shanmugapriya & Priya ., 2014
7	*Eucalyptus globulus* Labill.	Myrtaceae	Leaves, Essential oils	Methanol	*Staphylococcus aureus , Escherichia coli*	Aromatogram-me, Microatmosph-ere	Dongmo. , 2008
8	*Euphorbia hirta* L.	Euphorbiaceae	Leaves	Petroleum ether, Methanolic and Aqueous	*Escherichia coli, Staphylococcus aureus, Bacillus subtilis*	Agar well diffusion	Gupta *et al.*, 2019
9	*Ficus benghalensis* L.	Moraceae	Leaves	Ethanol	*Staphylococcus aureus, Streptococcus pneumoniae, Klebsiella pneumoniae, Pseudomonas aeruginosa and Escherichia coli*	Paper disc diffusion	Tkachenko *et al.*, 2017
10	*Ficus carica* L.	Moraceae	Leaves	Methanol	*Streptococcus mutans, Streptococcus sanguinis, Streptococcus sobrinus, Streptococcus ratti, Streptococcus criceti, Streptococcus anginosus Streptococcus gordonii, Aggregatibacter actinomycetemcomitans, Fusobacterium nucleatum, Prevotella intermedia, Porphyromonas gingivalis, Escherichia coli, Staphylococcus aureu, Staphylococcus epidermidis, Streptococcus pyogene*	Minimum Inhibitory Concentration (MIC)	Ghalem and Mohamed., 2008
11	*Jatropha curcas* L.	Euphorbiaceae	Stem, Bark	Ethanol, Methanol, Aqueous	*Staphylococcus aureus, Pseudomonas aeruginosa, Escherichia coli, Streptococcus faecalis, Staphylococcus epidermidis, Shigella dysenteriae, Micrococcus kristinae, Klebsiella pneumonia, Bacillus cereus, Bacillus subtilis, Proteus vulgaris, Serratia marcescens*	Agar-well diffusion	Igbinosa *et al.*, 2009

12	*Lantana indica* L.	Verbenaceae	Leaves	Ethyl acetate, Methanol	*Bacillus subtilis, Staphylococcus aureus, Streptococcus pyrogens, E.coli, Proteus vulgaris, Klebsiella pneumoniae , Candida albicans*	Agar well diffusion	Venkataswamy *et al.*, 2010
13	*Nelumbo nucifera* Gaertn	Nelumbonaceae	Flower	Hydroethanolic extract	*Escherichia coli, Klebsiella pneumonia, Pseudomonas aeruginosa, Bacillus subtilis, Staphylococcus aureus*	Agar diffusion method	Brindha and Arthi ., 2010
14	*Newbouldia laevis* P.Beauv.	Bignoniaceae	Leaves	Methanol	*Pseudomonas aeruginosa, Escherichia coli, Staphylococcus aureus, Salmonella typhi, Klebsiella spp. , Candida albicans*	Minimum Inhibitory Concentration (MIC)	Usman,and Osuji ., 2007
15	*Oxalis corniculate* L.	Oxalidaceae	Leaves	Methanol	*S. aureus, MRSA and E. coli, Salmonella Typhi, P. aeruginosa, K. pneumoniae, Citrobacter koseri , mold Rhizopus, Aspergillus niger , Aspergillus flavus, yeast Candida albicans , Escherichia coli Staphylococcus aureus*	Minimum Inhibitory Concentration (MIC)	Manandhar *et al* ., 2019
16	*Phyllanthus amarus* Schum. & Thonn.	Euphorbiaceae	Whole plant	Aqueous Acetone	*Bacillus subtilis Staphylococcus aureus , Enterococcus fecalis , Salmonella typhi , Salmonella paratyphi , Proteus vulgaris Serratia marsescens*	Dispersion method	Pathak *et al.*, 2017
17	*Psidium guajava* L.	Myrtaceae	Leaves	Hexane, Ethyl acetate, Methanol	*Staphylococcus aureus, Salmonella sp., Escherichia coli*	Agar well diffusion	Gonçalves *et al.*, 2008
18	*Stephania glabra* Roxb.	Menispermaceae	Rhizome	Ethanol, Hexane, Acetone.	*Staphylococcus mutans, Staphylococcus epidermidis, Escherichia coli, Klebsiella pneumonia*	Agar disc diffusion method	Semwal *et al.*, 2009
19	*Tecoma stans* (L.) H. B. & K.	Bignoniaceae	Whole plant	Ethanol, Methanol, Aqueous	*Pseudomonas fluorescens, Clavibacter michiganensis sub sp. michiganensis, Xanthomonas axanopodis pv. malvacearum, Staphylococcus aureus, E. coli, Pseudomonas aeruginosa and Klebsiella pneumonia*	Paper disc method	Sadananda *et al.*, 2011

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20	*Woodfordia fruticose* (L.) Kurz	Lythraceae	Stem, Flower	Petroleum ether, Chloroform, Diethyl ether, Acetone.	*Escherichia coli, Bacillus subtili, Staphylococcus aureus , Pseudomonas aeruginosa*	Disc diffusion method	Chougale *et al.*, 2009

CONCLUSION

Phytochemical survey of different medicinally important plants has revealed a large number of compounds including flavonoids and phenolics which show potent antioxidant activities. Abundant chemicals components have been isolated and identified from various plants parts but whether is the components are suitable as quality control ingredients and their pharmacological activity are still need further researched and analyzed. These compounds have been used as antioxidant, ant-carcinogenic, antifungal, antibacterial, anti-spasmodic, anti-inflammatory, and anti-diabetic. The present investigation suggests that medicinal plants which possess good antioxidant potential are the best supplements for the diseases associated with oxidative stress. The large diversity of phytoconstituents has shown to have therapeutic potentials as an antimicrobial agent as well as antimicrobial resistance against various microbes.

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