



IMPORTANT FINDINGS ON PLANTS HAVING ANTIOXIDANT PROPERTY: A REVIEW

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ABSTRACT

Plants have certain biologically active molecules and many of the present drug discoveries are based on these molecules found in the plants used in traditional system of medicine. In this review paper 20 plants (*Emblica officinalis* Linn., *Andrographis paniculata* (Burm.f.)Nees, *Curcuma domestica* Valet, *Trigonella foenumgraecum* Linn., *Camellia sinensis assamica* (Masters) Kitomura, *Centella asiatica* (L.)Urban, *Mangifera indica* Linn., *Hypericum perforatum* L., *Cymbopogon citratus*(DC)Staf, *Vitex negundo* Linn., *Hemidesmus indicus* R.Br., *Catharanthus roseus*(Linn.)G.Don, *Euphorbia hirta* Linn., *Prunus persica* (Linn.)Stokes, *Oxalis corniculata* Linn., *Withania somnifera*, *Tinospora cordifolia* (Willd.) Miers ex Hook. F. & Thoms, *Amaranthus spinosus* L., *Alternanthera sessilis* (L.) R. Br. ex. DC., *Garcinia cowa* Roxb.) are viewed which have antioxidant property. Studies on these plants may throw light on various therapeutic potential and uses of these herbs and plants.

Keywords: Antioxidant; drug discovery; traditional system of medicine; therapeutic uses.

INTRODUCTION

Many plants have antioxidant properties which protect our cells from oxidative damage, which is further linked to many diseases. These antioxidant properties of plants are due to various phytochemicals present in the plants. It was reported that the first significant contribution from Ayurvedic materia medica came with the isolation of the hypertensive alkaloid from the sarpagandha plant (*Rauwolfia serpentina*), valued in Ayurveda for the treatment of hypertension, insomnia, and insanity¹. Some other important interesting medicinal plants are being reported, for example, the recent report on *Croton caudatus* (Euphorbiaceae) as anticancer from Churachandpur district, Manipur India which had caught many National News papers' attention².

The medicinal properties of plant species have made an outstanding contribution in the origin and evolution of many traditional herbal therapies. These traditional knowledge systems have started to disappear with the passage of time due to scarcity of written documents and relatively low income in these traditional systems of medicine. Over the past few years, however, the medicinal plants have regained a wide recognition due to an escalating faith in herbal medicine in view of its lesser side effects compared to allopathic medicine in addition the necessity of meeting the requirements of medicine for an increasing human population³. Traditional Indian Medicine- Ayurveda has a long history and is one of the great living traditions. The ethno pharmacology knowledge, its holistic and systems approach supported by experiential base can serve as an innovative and more powerful discovery engine for newer, safer and affordable medicines⁴.

The present paper is concerned with the following objectives:

- 1) To know about some important medicinal plants with antioxidant property and
- 2) To collect information on some potential plants/ herbs for the benefit of the society as a whole.

Examples of some plants having antioxidant activity

1. *Emblica officinalis* Linn.

*Emblica officinalis*Linn. (Family: Euphorbiaceae) are used in Ayurveda as a potent rasayanas, a class of plant-derived drugs reputed to promote health and longevity by increasing defense against disease⁵. For many years the therapeutic potential of the fruits was attributed to their high content of ascorbic acid: about 1 g of vitamin C per 100 ml of fresh juice⁶. Study showed that the administration of *E. officinalis* significantly prevents the restrain-stress-induced oxidative stress and this may be due to its strong antioxidant property⁷.

2. *Andrographis paniculata* (Burm.f.)Nees

Andrographis paniculata (Burm f.) Nees (Family: Acanthaceae) is a perennial herb widely cultivated in tropical and subtropical areas, south-east Asia and India. In India it is known as 'Kalmegh' and in China it is called 'Chuan Xin Lian' and traditionally used as febrifuge, tonic, stomachic and anthelmintic⁸. In a study the diterpenes andrographolide (I), andrographiside (II) and neoandrographolide (III) isolated from *Andrographis paniculata* were investigated for their protective effects on hepatotoxicity induced in mice by carbon tetrachloride or *tert*-butylhydroperoxide (tBHP) intoxication. It was determined that the greater protective activity of II and III could be due to their glucoside groups which may act as strong antioxidants⁹.

3. *Curcuma domestica* Valet (Family: Zingiberaceae)

In another work the turmeric anti-oxidant protein (TAP) had been isolated from the aqueous extract of turmeric. The anti-oxidant principle was found to be a heat stable protein. The anti-oxidant principle had an absorbance maximum at 280 nm. After gel filtration, the protein showed a 2-fold increase in antioxidant activity and showed 2 bands in the SDS-PAGE with approximate molecular weight range of 24 000 Da¹⁰. In a study in which protective effects of *Curcuma longa* on ischemia-reperfusion induced myocardial injuries and their mechanisms were investigated the antioxidant parameters were also studied. Their results showed that cardio protective

effect of *Curcuma longa* extract, suppression of oxidative stress and improved ventricular function are correlated¹¹.

4. *Trigonella foenum-graecum* Linn.

Fenugreek (*Trigonella foenum-graecum*), (Family: Leguminosae)

An investigation shows ground beef patties (75% lean) containing synthetic antioxidants, or Fenugreek (*Trigonella foenum-graecum*) extracts were cooked to internal temperature 70°C, and evaluated for storage stability at 4°C. Samples with Fenugreek extracts showed better oxidative stability and it was claimed that Fenugreek may be a promising natural antioxidant source¹².

5. *Camellia sinensis assamica* (Masters) Kitomura (Family: Theaceae)

Green tea (*Camellia sinensis*) is consumed daily between the meals or after meals in Japan and other Asian countries. In recent years, green tea and its major polyphenolics have been demonstrated to prevent chemically induced tumors in a variety of experimental animal models system. The exact mechanism(s) of its anticarcinogenic activity remains to be elucidated, but green tea polyphenolics have demonstrated antimutagenic, anticarcinogenic, antioxidant, and antipromotional effects, including inhibition of Phase I and inducing Phase II enzymes¹³.

6. *Centella asiatica* (L.) Urban

Centella asiatica (Linn.) Urban, Synm. *Hydrocotyle asiatica* Linn. (Family: Apiaceae). *Centella asiatica* L. has been used as a medicinal herb for thousands of years in India, China, Sri Lanka, Nepal and Madagascar¹⁴. Asiaticoside derived from the plant *Centella asiatica* is known to possess good wound healing activity. Enhanced healing activity has been attributed to increased collagen formation and angiogenesis. Crude extract of *Centella asiatica* as well as asiaticoside derived from *Centella asiatica* showed good wound healing activity in both normal and delayed-type healing models¹⁵.

7. *Mangifera indica* Linn. (Family: Anacardiaceae)

An extract of *Mangifera indica* Linn. (Vimang) was tested *in vitro* for its antioxidant activity using commonly accepted assays. It showed a powerful scavenger activity of hydroxyl radicals and hypochlorous acid and acted as an iron chelator¹⁶.

8. *Hypericum perforatum* L. (Family: Hypericaceae)

In another study, several extracts were prepared, with different solvents, from a single stock of plant drug, collected from the wild. They were HPLC analyzed, and results were coupled with an evaluation of the antioxidant activity *in vitro* of each extract. Water extracts maintained a good activity, although they were obviously lacking hypericin and hyperforin. It was remarkable that extract (V), obtained by decoction, and possessed a good antioxidant activity, with an IC₅₀ value comparable with usual reference compounds¹⁷.

9. *Cymbopogon citratus* (DC) Staf.

Leaves of *Cymbopogon citratus* (Family: Gramineae). The radical scavenging activity of five Thai medicinal plants used in primary health care namely; *Curcuma longa* (Zingiberaceae), *Cymbopogon citratus* (Gramineae), *Coccinia grandis* (Cucurbitaceae), *Psidium guajava* (Myrtaceae) and *Cucurbita pepo* (Cucurbitaceae) was determined. When measured the scavenging effect on DPPH radical, methanolic extract of *C. longa* rhizome exhibited the highest radical scavenging activity with EC₅₀ of 0.34 mg/mL. The result reveals that higher concentration of

phenolic content is associated with a the higher radical scavenging activity¹⁸.

10. *Vitex negundo* Linn. (Family: Verbenaceae)

Vitex negundo produced significant ($P < 0.05$) reduction in MDA levels after 14-day treatment in only the higher dose (500 mg/kg/po) which has indicated that *Vitex negundo* can produce reduction of oxidative stress mainly by reducing lipid peroxidation, which needs to be substantiated by a detailed study¹⁹. During screening of antioxidant activity, total phenolics and GC-MS study of *Vitex negundo* leaf extract, it was found that the extract was rich in antioxidants, phenolics, flavonoids and many phytochemicals which contributes the activities like antimicrobial, antioxidant anticancer, Hypercholesterolemic, Antiulcerogenic and other activities²⁰.

11. *Tylophora indica* (Burm.f.) Merr.

Synm. *Hemidesmus indicus* R.Br. (Family: Asclepiadaceae) This medicinal plant is being widely used, either as single drug or in combination in health care delivery. Indian Sarsaparilla, *Hemidesmus indicus* (Family: Asclepiadaceae) is a commonly known Indian Medicinal Plant, which is widely recognized in traditional systems of medicine²¹. The results of methanolic extract of *H. indicus* were comparable with the standard hepatoprotective agent silymarin (100 mg/kg). Their results suggest that methanolic extract of *H. indicus* roots possesses a potential antihepatotoxic activity²².

12. *Catharanthus roseus* (Linn.) G. Don

Catharanthus roseus (L.) G. Don. (Family: Apocynaceae) is used for treating many fatal diseases, and has good antioxidant potential²³. Antioxidant responses were analyzed in *Catharanthus roseus* (L.) G. Don. with peroxidase (POX, EC 1.11.1.7) activities. The changes found in catalase (CAT, EC 1.11.1.6) activities may be of great importance in the H₂O₂ detoxification mechanism under oxidative stress²⁴.

13. *Euphorbia hirta* Linn.

Euphorbia hirta (Family: Euphorbiaceae). The antioxidant activity of extracts were evaluated by various antioxidant assays, including DPPH free radical scavenging activity, superoxide anion radical scavenging, nitric oxide scavenging and reducing power assay. The various antioxidant activities were compared to standard antioxidants such as butylated hydroxyl anisole and ascorbic acid. All the extracts showed antioxidant activity in all the tested methods²⁵. First *in vitro* report showing *E. hirta* L. as potent source of natural antioxidants suggests *E. hirta* L. as promising plant source in health, food and cosmetic industry²⁶.

14. *Prunus persica* (Linn.) Stokes, (Family: Rosaceae). This economically important fruit crops such as apples (genus *Malus*), pears (genus *Pyrus*), raspberries/blackberries (genera *Rubus*), strawberries (genus *Fragaria*), and stone-fruits such as peaches, plums, cherries, almonds, apricots (genus *Prunus*)²⁷. In a study on peach, the HPLC analysis of phenolic compounds showed that rutin, (-)-epicatechin gallate, hydrocinnamic acid, sinopinic acid, dithiothreitol and caffeic acid were major constituents. The results suggested that peach kernel oil is a good source of the unsaturated fatty acid, phenolic compounds with strong antioxidant activity, and has the potential to be used as nutrient rich food oil, also their results verified that peach kernel meals contained higher amounts of total phenolic and stronger antioxidant activities than oils, enabling their application as ingredients for functional or enriched foods²⁸.

15. *Oxalis corniculata* Linn. (Family: Oxiladaceae)

A study on evaluating antitumor and antioxidant activity of *Oxalis corniculata* Linn. against Ehrlich Ascites Carcinoma (EAC) - induced in swiss albino mice revealed the presence of several phytochemicals viz. phytosterol, glycosides, flavonoids and tannins. It was observed in this study that the administration of EEOC at different doses increased CAT levels in a dose-dependent manner, which might be indicating the antioxidant and free scavenging property of EEOC²⁹. A review mentioned the botany, photochemistry, biochemistry, traditional knowledge, pharmacological and therapeutic application of the plant *Oxalis corniculata* Linn.³⁰.

16. *Withania somnifera* (Family: Solanaceae)

A study showed that *Withania somnifera* possess good immunomodulatory anti-inflammatory, anti-tumor, antioxidant, anticancer properties and many pharmacologically and medicinally important chemicals, they protect the cells from oxidative damage and diseases³¹. In one more study antioxidant activity of *Withania somnifera* glycowithanolides was reported³².

17. *Tinospora cordifolia* (Willd.) Miers ex Hook. F. & Thoms (Family- Menispermaceae)

In an experiment the aqueous extract of roots of *T. cordifolia* has shown the anti-oxidant action in alloxan diabetes rats. Important medicinal properties reported were anti-diabetic, anti-periodic, anti spasmodic, anti-inflammatory, anti-arthritis, anti-oxidant, anti-allergic, anti-stress, anti-leprotic, anti-malarial, hepatoprotective, immunomodulatory and anti-neoplastic activities³³. An experiment on alloxan-induced diabetic rats, GSH concentration was found to be decreased in comparison with normal rats but on treatment with 100mg/kg body weight of *Tinospora cordifolia* root extract, the GSH concentration was brought back to normal values. Likewise, all other parameters in the diabetic rats were normalized³⁴.

18. *Amaranthus spinosus* L. (Family: Amaranthaceae)

It was concluded from an experiment that *Amaranthus spinosus* extract possesses significant hepatoprotective activity which might be due to antioxidant defence factors and phenolics present in the plant which might be the main constituents responsible for this activity³⁵.

19. *Alternanthera sessilis* (L.) R. Br. ex. DC. (Family: Amaranthaceae)

The antioxidant activity was studied by phosphomolybdate method and DPPH method. The superoxide radical scavenging activities of different solvent extracts of *A. sessilis* were determined using a base catalyzed pyrogallol auto-oxidation. This study showed both antioxidative and metal ion chelating activity³⁶.

20. *Garcinia cowa* Roxb. (Family: Guttiferae)

In another investigation, antiaflatoxigenic and antioxidant activities of *Garcinia* extracts were studied in which both the hexane and chloroform extracts from the dried rinds of *G. cowa* and *G. pedunculata* were evaluated. It was assumed that antioxidant properties of *Garcinia* extract might be due to the presence of various xanthenes with phenolic functional groups³⁷. Five xanthenes named cowagarcinone A–E and six previously reported xanthenes were isolated from the latex of *Garcinia cowa* Roxb. and investigated for their radical scavenging activities³⁸.

DISCUSSION AND CONCLUSION

Many Indian medicinal plants have come under scientific scrutiny since the middle of the nineteenth century, although

in a sporadic fashion. The materia medica of Ayurveda, and other similar repositories of knowledge from other cultures, represents a valuable resource for development of not only medicinal preparations but also nutraceuticals and cosmeceuticals according to modern-day requirements. If a product is too complex, it must be standardized in terms of biologic activity parameters¹. The plants used for various therapies are readily available, are easy to transport, and have a relatively long shelf life³.

Many plants have been studied extensively and many of these plants are investigated and reinvestigated from time to time. Apart from this sustainable utilization of plant resources is a must in the present context and more survey work is required to gather information on antioxidant, anticancer and immunomodulatory effects of medicinal plants for the benefit of society as a whole.

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