*J. Phytol. Res.* **22**(1) : 139-142, 2009

# ANTIOXIDANT PROPERTIES OF FIVE MEDICINAL PLANTS OF SOLANACEAE

**S. KALAIMATHI, D. KADAMBAN and J. VELANGANNI**
Department of Botany, K.M. Centre for PG Studies, Puducherry - 605 008, India.

The present study aims to bring out the antioxidant property of five species of locally available Solanaceae plants. Their red-oxi potentials were studied and found that *Solanum xanthocarpum* showed the best antioxidant property compared to the other species confirming its usage in the traditional medicine. The phytochemical study revealed that all the five species contain polyphenols and flavinoids which might have contributed to the antioxidant property. Further investigations are required to bring out the phytochemical responsible for such property.

**Keywords:** Free radicals; Natural antioxidants; Oxidative stress; Phytochemicals; Reactive oxygen species.

An antioxidant is a chemical that prevents the oxidation of other chemicals. Oxygen free radicals induce damage due to peroxidation to biomembranes and also to DNA, which lead to tissue damage, thus cause a number of diseases. They protect key cell components by neutralizing the damaging effects of free radicals, which are natural by product of cell metabolism[1,2].

Antioxidant may be synthetic or natural. Synthetic antioxidants have recently been reported to be dangerous to human wealth. Thus, the search for effective non-toxic natural compounds with antioxidative activity has been intensified in recent time[3]. Potential sources of antioxidants compounds have been searched in several types of plant materials such as vegetables, fruits, leaves, oil seeds, cereal crops, barks, roots, spices, herbs and crude plant drugs[4,5].

A variety of antioxidant molecules have been identified, isolated and analysed from angiosperms. Antioxidant activity of *Acorus calamus*[6], *Aloe vera*[7], *Andrographis paniculata*[8], *Asparagus racemosa*[9], *Azadirachta indica*[10], *Baccopa monnieri*[11], *Desmodium gangeticum*[12], *Emblica officinalis*[13], *Semicarpus anacardium*[14], *Withania somnifera*[15], *Curculigo orchioides*[16], *Mucuna pruriens*[17] and *Tinospora cordifolia*[18] have been well studied.

The research activities on natural antioxidants have contributed to new or renewed public interests world wide in medicines, health foods and nutritional supplements. Plants have been used for treatment or prevention of various human diseases. The importance of the antioxidants constituents of plant materials in the maintenance of health and protection from coronary heart disease and cancer is also raising interest among scientists, food manufacturers, and consumers as the trend of the future is moving toward functional food with specific health effects[19]. The antioxidant activity of phenolics is mainly due to their red- ox properties, which allow them to act as reducing agents, hydrogen donators and singlet oxygen quenchers[20]. Antioxidant defense includes the antioxidant enzymes Like SOD, CAT, GSH – PX, etc., low molecular agents and dietary antioxidants[21]. Antioxidant nutraceuticals are those which contrain vitamin – D, vitamin – C, vitamin – A and B – carotene.

The plants are producing a wide range of low molecular weight chemical compounds, termed secondary metabolites or phytochemicals. The phytochemicals include alkaloids, phenolic acids, flavonoids, steroids, terpenoids and saponins.

Antioxidants are rich in natural diets. They are able to stop free radicals damage by having proper oxidative reductive potential. In order to evaluate the potential health benefit of the common leafy vegetables of certain medicinal plants of Solanaceae family with reference to their phytochemical constituents, nutritional values and their antioxidant properties were analysed.

In order to study the antioxidant properties of five medicinal plants, belonging to the family Solanaceae, namely *Solanum nigrum, S. trilobatum, S. torvum, S. xanthocarpum* and *Datura stramonium* were collected and identified. Their names were confirmed with the help of standard flora[22-24] and Herbarium at French Institute, Puducherry.

**Table 1.** Redox potential values of five species of family Solanaceae.

| Species Name | Redox potential value at different concentration of methanolic extract | | | | |
|---|---|---|---|---|---|
| | 100 ppm | 200 ppm | 300 ppm | 400 ppm | 500 ppm |
| *Datura stramonium* | 0.242<br>+ 0.115*<br>0.357 | 0.242<br>+ 0.117*<br>0.359 | 0.242<br>+ 0.121*<br>0.363 | 0.242<br>+ 0.124*<br>0.366 | 0.242<br>+ 0.127*<br>0.369 |
| *Solanum nigrum* | 0.242<br>+ 0.092*<br>0.334 | 0.242<br>+ 0.095*<br>0.337 | 0.242<br>+ 0.100*<br>0.342 | 0.242<br>+ 0.104*<br>0.346 | 0.242<br>+ 0.109*<br>0.351 |
| *Solanum torvum* | 0.242<br>+ 0.078*<br>0.320 | 0.242<br>+ 0.081*<br>0.323 | 0.242<br>+ 0.086*<br>0.328 | 0.242<br>+ 0.090*<br>0.332 | 0.242<br>+ 0.097*<br>0.339 |
| *Solanum trilobatum* | 0.242<br>+ 0.049*<br>0.291 | 0.242<br>+ 0.052*<br>0.294 | 0.242<br>+ 0.057*<br>0.299 | 0.242<br>+ 0.062*<br>0.304 | 0.242<br>+ 0.067*<br>0.309 |
| *Solanum xanthocarpum* | 0.242<br>+ 0.018*<br>0.260 | 0.242<br>+ 0.031*<br>0.273 | 0.242<br>+ 0.038*<br>0.280 | 0.242<br>+ 0.039*<br>0.281 | 0.242<br>+ 0.040*<br>0.282 |

E Calamel = 0.242, * = E Cell

The experimental plants were shade dried and soaked in methanol for 48 hours. Then, the methanolic extracts were evaporated to get sample in a powder form. All the five samples were used for phytochemical analysis. Biochemical tests were conduced to identify the phytochemical group of components. Test for polyphenols, flavanoid, $NaHCO_3$ test, Borsche's test, Tallen's Reagent test; test for nitrogen, sodium fusion test was conducted[25]. Using Redox potentiometer, the redox potential values of five medicinal plants of Solanaceae were determined with different concentrations of methonolic extract of each sample (100, 200, 300, 400, 500 ppm).

The principle generally used in potentiometer is that of Poggendroff compensation method. To minimize the diffusion potential during measurement the two electrodes were connected by means of a salt bridge.

E = E + (Cathode) – E – (Anode)

The reference cell used is a Saturated KCl Calamel elctrode, the standard reduction potential at 25°C is 0.242 V[26]. From the redox potential values, the antioxidant properties of the plants were calculated using the formula.

E cell = E Sample – E Calamel

E Calamel 0.242 for saturated KCl

Therefore, E Sample = E cell + E Calamel. The lower the red-ox potential, the higher will be its antioxidant potential.

The phytochemical analysis confirmed the presence of polyphenols and flavonoids in all the five species of Solanaceae studied. It confirms the report of Rice-Evans *et al.*[20] and Govindarajan *et al.*[9] that polyphenols and flavonoids are responsible for their antioxidant properties.

From the methanolic extract of the leaves of each species, five different concentrations were prepared (100, 200, 300, 400, 500 ppm). Total 25 samples were prepared and their reduction potentials were determined by using the potentiometer and their values were tabulated (Table 1). The presence of antioxidant property in the leaves is in accordance with the report of Ramrathinam *et al.*[4] and Govindarajan *et al.*[5].

The values were plotted on the graph bringing the relationship between reduction potential and various concentration of methanolic extract of the samples. It is inferred that *S. xanthocarpum* shows the lowest redox potential, indicating its higher antioxidant property, even

in low concentration. From the above data *S. xanthocarpum* exhibited the best antioxidant property compared to other species. The antioxidant properties of other species were in the order: *S. trilobatum* > *S. torvum* > *S. nigrum* > *Datura stramonium*. *S. xanthocarpum* can be taken for the further studies in clinics and can be used as therapeutic agent not only in traditional medicine but also in modern medicines. This study confirmed the presence of antioxidant properties in all the five species studied. They may be exploited as the best source in curing oxidative stress and human diseases.

**References**


1. Shenoy R and Shirwaikar 2002, Anti-inflammatory and free radical scavenging studies of *Hyptis suaveolens* (Labiatae). *Indian drugs* **39** (11) 574 – 577.
2. Ames B N, Shigenga M K and Hagen T M 1993, Oxidants, antioxidants and the degenerative diseases of aging. *Proc. Nat. Acad. Sci.* **90** 7915-7922.
3. Gupta V K and Sharma S K 2006, Plants as natural antioxidants. *Nat. Pro. Rad.* **5** (4) 326 – 334.
4. Ramarathinam N, Ochi H and Takeuchi M 1997, Antioxidant defense system in vegetable extracts. In: *Natural antioxidant chemistry, Health Effects and Applications*. Shaditit, F (Ed). AOCS Press, Champaign IL-76-87.
5. Govindarajan R, Vijayakumar M, Rawat A K S and Mehotra S 2006, Free radical scavenging potential of *Picrorhiza kurroa* Royle ex Benth. *Indian J. Exp. Biol.* **41** 875-9.
6. Govindarajan R, Agnihotri A K, Khatoon S, Rawat A K S and Mehrota S 2003, Pharmacognostical evaluation of an antioxidant plant – *Acorus calamus*. *Nat. Prod. Sci.* 9 264-9.
7. Hu Y, Xu J and Hu Q 2003, Evaluation of antioxidant potential of *Aloe vera* (*Aloe barbadensis* Miller.) extracts. *J. Agri. Food. Chem.* **51** 788-91.
8. Trivedi NP and Rawal UM 2001, Hepatoprotective and antioxidant property of *Andrographis paniculata* (Nees) in BHC induced liver damage in mice. *Indian J. Exp. Biol.* **39** 41-46.
9. Govindarajan R, Vijayakumar M, Rao ChV, Vivek Kumar, Rawat AKS and Pushpangadan P 2004, Action of *Asparagus racemosus* against streptozotocin – induced oxidative stress. *Nat. Prod. Sci.* **10** 177-81.
10. Rao AD, Devi KN and Thyagaraja K 1998, Isolation of antioxidant principle from *Azadirachta* seed kernels; determination of its role on plant lipoxygenases. *J. Enzyme Inhibition* **4** 85-96.
11. Rohini G, Sabitha KE, Devi CS 2004, *Bacopa monniera* Linn. extract modulates antioxidant and marker enzyme status in fibrosarcoma bearing rats. *Indian J. Exp. Biol.* **42** 776-80.
12. Govindarajan R, Rastogi S, Vijayakumar M, Rawat A K S, Shirwaikar A, Mehotra S, Pushpagandan P 2003, Studies on the antioxidant activities of *Desmodium gangeticum*. *Biol. Pharm. Bull.* **26** 1424-7.
13. Chaudhuri RK 2002, *Emblica* cascading antioxidant: a novel natural skin care ingredient. *Skin Pharmacol. and Applied Skin Physiol.* **15** 374-80.
14. Premalatha B, Sachdanandam P 1999, *Semecarpus anacardium* L. nut extrct administration induces the *in vivo* antioxidant defence system in aflatoxin B1 mediated hepatocellular carcinoma. *J. Ethnopharmacol.* **66** 131-9.
15. Chaurasia S S, Panda S, Kar A 2000, *Withania somnifera* root extract in the regulation of lead – induced oxidative damage in male mouse. *Pharmacol. Res.* **41** 663-6.
16. Tang SY, Whiteman M, Peng ZF, Jenner A, Yong EL and Halliwell B 2004, Characterization of antioxidant and antiglycation properties and isolation of active ingredients from traditional chinese medicines. *Free radical Biol. Med.* **36** 1575-87.
17. Tripathi YB and Upadhyay AK 2002, Effect of the alcohol extract of the seeds of *Mucuna pruriens* on free radicals and oxidative stress in albino rats. *Phytother. Res.* **16** 534-8.
18. Subramanian M, Chintalwar G J and Chattupadhyay S 2002, Antioxidant properties of *Tinospora cordifolia* polysaccharides against iron-mediated lipid damage and gamma-ray induced protein damage. *Redox Reports* 7 137-143.
19. Sinha R K and Shweta Sinha S 2001, *Ethnobiology : Role of indigenous and Ethnic societies in Biodiversity conservation, Human Health Protection and Sustainable Development*, Surabhi Publications, Jaipur. p.257.
20. Rice- Evans C A, Miller N J, Bolwell P G Bramley, P M and Pridham J B 1995, The relative antioxidant activites of plant derived polyphenolic flavonoids. *Free radicals Res.* **22** 375- 383.
21. Halliwell B and Gutteridge J M C 1999, Antioxidant defences In : *Free radicals in Biology and medicine*, Oxford University Press, Newyork 175.
22. Gamble J S 1935, *Flora of the Presidency of Madras*. Vol. I, Adlard and Son Ltd., London, U.K.
23. Matthew K M 1982, *Illustration on the Flora of Tamil Nadu Carnatic*. The Rapinat Herbatium,

Tiruchirapalli, India. p.34.
24. Matthew, K M 1983, *The flora of the Tamil Nadu Carnatic.* Part, The Rapinat Herbarium, Tiruchirapalli, India, p.46.
25. Horborne J B 1984, *Phytochemical methods* (2nd Edn.). Chapman and Hall Ltd. London, New York.
26. Puri and Sharma 1995, Potentiometer Text book of Physical chemistry. p.288-291.