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Antioxidant Potential And In Vitro Free Radical Scavenging Activity Of *Aerva lanata*

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Abstract: In this paper the enzymic antioxidants (catalase, peroxidase, glutathione-s-transferase, glutathione reductase and superoxide dismutase) and non-enzymic antioxidants (ascorbic acid, α tocopherol, carotenoids, flavonoids and polyphenols) of the flower and root of *Aerva lanata* are discussed. The free radical scavenging activity, of different extracts of *Aerva lanata* was analyzed. The results showed that the extracts form a good source of all the antioxidants analysed and identified.

Key Words : *Aerva lanata,* antioxidants, DPPH, free radicals, medicinal plants, oxidative stress.

INTRODUCTION

Free radicals and reactive oxygen, nitrogen species (ROS and RNS) are formed as a result of normal cellular oxidative metabolic reactions. Most organisms have evolved antioxidant defense and repair systems against oxidative damage, however these systems are insufficient to prevent the damage entirely. Accumulated evidences suggest that RNS can be scavenged through chemoprevention utilizing natural antioxidant compounds present in foods and medicinal plants. The most important free radicals identified to induce oxidative damages are commonly termed as ROS such as OH, HO_2, O_2, H_2O_2 and RNS such as NO, NO_2 and ONOO. In the case of disturbed balance between formation of free radicals and antioxidant defense in the cell, oxidative stress and the free radicals can play a role in the development of various diseases. Over production of ROS is implicated in the pathogenesis of host degenerative diseases including cardiovascular diseases, diabetes, cancer, Alzheimer's disease, retinal degeneration, ischemic dementia, neurodegenerative disorders and aging[1]. Many natural products are reported to contain large amounts of antioxidants[2].

Aerva lanata Linn (Amaranthaceae) known as polpala, is a prostrate to decumbent, sometimes erect perennial herb, found throughout tropical India as a common weed in fields and wasteland[3]. *Aerva lanata* has been claimed to be useful as diuretic, antidiabetic, expectorant and hepatoprotective in traditional system of medicine. The antimicrobial and cytotoxicity activity, diuretic, urolithiasis and anti-inflammatory activity of *Aerva lanata* has been reported[4].

The study was conducted to establish the traditional use of *Aerva lanata* as antioxidative agent against free radicals.

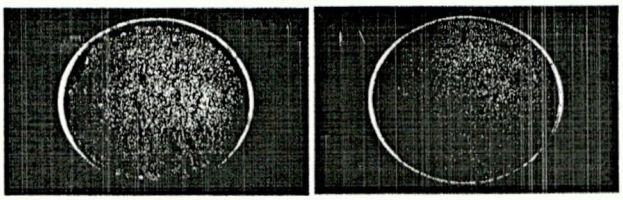
MATERIALS AND METHODS

Plant material: The sample was bought from local market in Coimbatore and duly authenticated. The freshly collected plant was washed, air dried in the shade at room temperature for five days. Dried flowers and roots of *Aerva lanata* were powdered and stored until use. *Aerva lanata* and its flower and root powder are shown in Plate 1 and Plate 2.

Plate 1

Aerva lanata

Plate 2



Flower powder Root powder

Assessment of the activities of enzymic and non-enzymic antioxidants: The flower and root samples of *Aerva lanata* were analysed for the enzymic and non–enzymic antioxidants namely catalase[5], superoxide dismutase[6], glutathione reductase[7], gutathione peroxidase[8], glutathione-s-transferase[9], ascorbic acid[10], α-tocopherol[11], reduced glutathione[12], total carotenoids[13]

and flavonoids[14].

Determination of in vitro free radical scavenging activity: Five gram powdered sample of both the flowers and roots of *Aerva lanata* were sequentially extracted with solvents like petroleum ether, benzene, chloroform, acetone, methanol and also with water by Soxhlet apparatus for 48 hrs. Then it was filtered through Whatmann. no.1 filter paper and their crude extracts were evaporated in a water bath to give gummy solid residue. The residue was dissolved in dimethyl sulphoxide. These crude extracts were stored in refrigerator and screened for in vitro free radical scavenging activity. 0.001g of extracts per 20 µl was taken for the assay. Each extract was used for the determination of free radical scavenging activity such as scavenging of 1,2-diphenylpicryl-hydrazyl[15], inhibition of in vitro lipid peroxidation[16], inhibition of superoxide[17] and nitric oxide generation[18] and hydrogen peroxide scavenging activity[19].

Statistical analysis: Values are given as mean ± SD, and the difference between values were determined by the student's t-test. Values of $p < 0.05$ were considered significant.

RESULTS AND DISCUSSION

Enzymic antioxidants: The activities of enzymic antioxidants in flower and root of *Aerva lanata* are presented in Table 1.

Table 1. Activities Of Enzymic Antioxidants In The Flower And Root Of *Aerva lanata*

Enzymic antioxidants (U/g)	*Aerva lanata*		
	Flower	Root	t value
Catalase1	204 ± 7.4	241±14.1	2.4*
Superoxide dismutase2	5.0 ± 0.6	14 ± 0.2	15.8*
Glutathione reductase 3	0.21±0.07	0.42±0.11	8.03*
Glutathione-S-transferase4	0.07±0.01	0.13±0.01	9.93*
Glutathione peroxidase5	0.12±0.01	0.23±0.01	10.27*

Values are mean ± SD of triplicates * - Significant at 0.05 level
1-Amount of enzyme required to the optical density by 0.05 at 240 nm
2-Amount that cause 50 per cent reduction in the extent of NBT oxidation
3-µ moles of CDNB conjugated / minute
4-µ moles of NADPH utilized
5-µ moles of GSH utilized / minute

Non-enzymic antioxidants

The levels of the non-enzymic antioxidants were assessed and the results are presented in Table 2.

Table 2. Levels Of The Non-Enzymic Antioxidants In The Flower And Root Of *Aerva lanata*

Non-enzymic antioxidants (mg/g)	*Aerva lanata*		
	Flower	Root	t value
Ascorbic acid	0.35±.021	0.29±.01	5.044*
α-tocopherol	0.80±0.01	0.50±0.01	21.39*
Carotenoids	0.20±0.06	0.45±0.03	21.53*
Flavonoids	2.61±0.1	1.15±0.07	10.81*
Reduced glutathione	0.04±0.01	0.10±0.001	14.29*

Values are mean ± SD of triplicates, * - Significant at 0.05 level

In vitro free radical scavenging activity of *Aerva lanata*: A cardinal property of an antioxidant is the ability to scavenge free radicals. Free radicals are involved in the process of lipid peroxidation, and considered to play a fundamental role in several chronic diseases, such as cancer and cardiovascular disease and are implicated in the aging process[22]. Therefore, it was considered important to assess the free radical scavenging efficacy of the different plant extracts. Per cent inhibition of in vitro free radical scavenging activity of *Aerva lanata* are expressed in Table 3.

Table 3. Per Cent Inhibition Of In Vitro Scavenging Activity Of *Aerva lanata*

Free radical scavenging activity	Sample	Petroleum ether	Benzene	Chloroform	Acetone	Methanol	Aqueous
Scavenging of DPPH radical	Flower	45	55	64	58	78	46
	Root	59	37	38	59	73	44
Inhibition of in vitro lipid peroxidation	Flower	24	7	4	7	45	8
	Root	29	58	19	38	27	13
Inhibition of superoxide generation	Flower	72	56	78	79	84	75
	Root	69	76	71	85	73	77
Inhibition of nitric oxide generation	Flower	31	36	34	32	37	48
	Root	32	27	28	45	23	44
H_2O_2 scavenging activity	Flower	40	48	39	65	77	47
	Root	73	50	33	55	63	41

The results of the present study show that the *Aerva lanata* has considerable catalase activity in the flower and the root which indicate that they are rich in catalase enzyme. The activity of SOD was found to be maximum in the roots than that of the flower of *Aerva lanata*. The high level of these enzymes protects tissues against oxygen free radicals by catalyzing the removal of superoxide radical which damages the membrane and biological structures.

The results show that both flower and root of *Aerva lanata* has moderate source of glutathione reductase and glutathione-s-transferase. It is clear from Table 1, that the roots have higher activity of glutathione peroxidase than flowers. It may also reduce the risk of serious diseases caused by reactive oxygen species like cancer, cardiovascular diseases, hepatocellular damage, diabetes mellitus and aging.

Table 2 reveals that the flower and root of *Aerva lanata* contain all the non-enzymic antioxidants. In the case of ascorbic acid, α-tocopherol, the flower possessed higher levels than that of the root. The supplementation of a single antioxidant such as α-tocopherol would neutralize free radicals and other ROS or reactive nitrogen species (RNS) and thereby avoid any oxidative damage[20, 21].

From Table 3, it is clear that the methanol extract of both flower (78 per cent) and root (73 per cent) of *Aerva lanata* show a strong inhibition against DPPH radicals tested. Thus it may prevent the initiation and propagation of free radical mediated chain reactions by stabilizing reactive species via electron or hydrogen donation before such deleterious reactions can occur.

It is also evident from Table 3 that the acetone and methanol extracts of *Aerva lanata* possess potent scavenging effects of superoxide radicals which is more important for inflammation.

It is clear from Table 3 that there is no major difference in inhibition of lipid peroxidation in the flower of *Aerva lanata* by different solvents, although a marginal increase (23 per cent to 45 per cent) in its activity was observed in petroleum ether / methanol extracts compared to those of the remaining extracts.

This study showed the capability of both the flower and root extracts to scavenge free radicals, indicating that they may be useful therapeutic agents for treating radical related pathological damage.

CONCLUSION

The present study clearly indicates the extract from Aerva lanata possess good antioxidant properties and may serve as a potent free radical seavengers, acting possibly as primary antioxidants. However, further investigations in in vivo experiments are still necessary to further shed light on their efficacy in disease risk reduction.

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