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EFFECT OF VERMICOMPOST ON ANTIOXIDANT LEVELS IN *ANDROGRAPHIS PANICULATA*

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ABSTRACT

Vermicompost is usually a finely divided peat-like material with excellent structure, porosity, aeration, drainage and moisture holding capacity. It helps to process wastes simultaneously producing biofertilizers and proteins. The present study was carried out to find out the changes in the antioxidants levels in selected medicinal plant by the application of vermicompost and inorganic fertilizer at different time intervals (20, 40 and 60days). There is a significant (p<0.01) increase in the levels of enzymatic and non-enzymatic antioxidants at 60 days interval when compared to the control and inorganic fertilizer application. Inorganic fertilizer application caused the significant decrease in the antioxidants in the *Andrographis paniculata* No significant results are observed in the control without vermicompost.The result of vermicompost experiment indicated that application of vermicompost has positive effects on *Andrographis paniculata* and showed that the highest antioxidant levels compared with inorganic fertilizers.

Key words: Vermicompost, Andrographis paniculata, Antioxidants, Fertilizer.

I. INTRODUCTION

India has a wide biodiversity of medicinal plants that grow in forest and uncultivated areas. In present scenario of world trade organization and globalization, the demand of medicinal plants has increased many folds. Kalmegh (*Andrographis paniculata*) is an important medicinal plant of family Acanthaceae being used in Indian system of medicines since time immemorial(Misra et al., 1992). The plant is also known as rice bitters in West Indies and king of bitters or chiretta in England. Fertilizer management in integrated manner has beneficial effect on soil fertility and available plant nutrients resulting in sustainable crop production and quality. Waste is the spoilage, loss or destruction of either matter or energy, which is unusable to man. Gradually increasing civilization through industrialization and urbanization has led to increase in the generation of wastes polluting environment from various sources(Prabha et al., 2008). The fruit wastes generated in market yards, hostels, hotels and houses are dumped into an open land. This process not only reduces the available fertile land, which was used to produce food and raw materials, but also pollutes air, water and soil. To overcome this problem wastes can be used to produce valuable organic manure by using vermitechnology (Prabha et al., 2008). It is an important aspect of biotechnology involving the use of earthworms for processing various types of organic wastes into valuable resources (Jain, 2000). Vermicomposting helps to process wastes simultaneously giving biofertilizers and proteins Thus vermitechnology could successfully be used to clean the environment as it uses wastes as raw material to change polluted, costly chemical farming to suitable agriculture (Ramesh et al., 2011). Medicinal plants play an important role in the development of potent therapeutic agents. Herbal drugs form the backbone of the invaluable traditional medicinal

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practices (Manna et al., 2003). Recently interest in medicinal plant research has increased all over the world. It has been reported that medicinal plants used in various traditional systems have immune potential against various diseases.

Oxidative damage is one of the major causes of many diseases. The majority of free radicals initiates the chain reaction and damages the cells and cellular components. Preventing oxidative damage is the simple and effective way of preventing any disease (Garg et al., 2006; Khaliq et al., 2006). Antioxidants are any substances that delays or inhibits oxidative damage to a target molecule. The antioxidants protect the cells against ROS toxicity by preventing ROS formation, interception of ROS attack by scavenging the reactive metabolites, converting them to less reactive molecules, by enhancing the resistivity of sensitive biological targets to ROS attack, facilitating the repair of damage caused by ROS and finally by providing a favorable environment for the effective functioning of other antioxidants focus of this study is to determine how far the cheapest, eco-friendly vermicompost application influences on the enzymatic antioxidants and nonenzymatic antioxidants in selected medicinal plant *Andrographis Paniculata.*

II. MATERIAL AND METHODS

2.1 Collection and pre-decomposition of hostel waste

The fruit wastes were collected from fruit market , Vijayawada, and Andhra Pradesh, India. The collected waste was chopped into small pieces and allowed to partial decomposition for 20 days. Then the wastes were mixed with cow dung in 3:1 ratio and used for vermicomposting.

2.1.2 Collection and Culturing of earthworms

The epigamic earthworms *Eudrilus eugeniae* were collected from Agrigold farms Kanchikacherla, India. The species were cultured for six months.

2.1.3 Cultivation of medicinal plant Andrographis Paniculata

The selected medicinal plant *Andrographis Paniculata Linn* was cultivated during late winter and early summer to attain the optimum growth conditions planted in different pots as follows.
Group I-Control (without any manure)
Group II-In organic Fertilizer
GroupIII-Vermicompost at different concentration 25%, 50%, 75%, 90% and 100%.
In the medicinal plant the activity of enzymatic and non-enzymatic antioxidant were estimated according to the procedure described by Sinha (1972).

2.1.4 Statistical Analysis

For the purpose of statistical analysis. Duncan's multiple range tests was applied for comparing the levels of Antioxidants at different time intervals.

III. REULTS AND DISCUSSION

3.1 Antioxidants of *Andrographis Paniculata*

Oxidative stress is often measured by observing the damage inflicted by oxygen radicals upon various biomolecules, such as lipids, proteins or deoxyribonucleic acid. In addition to this, aspects of the antioxidant defense system are also often examined as an indirect market of oxidative stress.

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Table 1. effect of vermicompost on the levels of non-enzymatic antioxidants in plant tissue of control.

S.no	Group	Group 1 (control)	Inorganic grown(Group 2)	Vermicompost(Group 3)
1	GSH	4.42 ± 0.17c*	2.55 ± 0.21	** 3.06 ± 0.15b**
2	Vit E	3.35±0.10c*	3.24±0.34a**	3.24 ± 0.20b**
3	Vit C	8.42 ± 0.29c*	4.99 ± 0.10a**	7.00 ± 0.50b**
4	Beta carotene	4.17 ± 0.16c*	2.09 ± 0.06a**	5.03 ± 0.23b**

Values are expressed mean ± S.D, (n=6); *p<0.05,**p<0.01, ns- Not significant

Statistical Comparisons
A–Group II is compared with Group I; B–Group III is compared with Group I; C-Group I is compared with Group III

Units:
GSH -μ of GSH consumed / minb / mg protein; Vit C, ß- Carotene, Vit E -μg / mg protein

Table 2. .Effect of vermicompost on the levels of non-enzymatic antioxidants

s.no	Group	Control (Group 1)	Inorganic fertilizer (Group2)	Vermicompost 90%(Group3)
1	SOD	19.55 ± 1.75c*	22.55 ± 1.75c*	25.52 ± 1.6 b**
2	Catalase	68.38 ± 2.99c*	47.23 ±0.99a**	68.03 ± 2.80b**
3	GPx	5.03 ± 0.54c*	3.09 ± 0.48a**	4.06 ± 0.6b**

Values are expressed mean ± S.D, (n=6) *p<0.05,**p<0.01, ns- Not significant

Statistical Comparisons
A – Group II is compared with Group I; B – Group III is compared with Group I; C- Group I is compared withGroup III

Units:
SOD – 50% inhibition of nitrate / min / mg protein. CAT -μ moles of H2O2 decomposed / min / mg protein.
GPX - μ of GSH utilized / min / mg protein.

3.1.2 Non-enzymatic antioxidants *Andrographis Paniculata*

The levels of total reduced glutathione (GSH), vitamin E, vitamin C and B-carotene in the plant tissues of control and experimental groups are showed in the Table 1. It is evident that the levels of nonenzymatic antioxidants namely total reduced glutathione (GSH), vitamin E, vitamin C and B-carotene were significantly lower in inorganic fertilizers grown as compared to control plants. Application of vermicompos,t the activities were brought the levels to normal. Glutathione is an important naturally occurring antioxidant, as it prevents the hydrogen of the sulfahydral group to be abstracted instead of ethylene hydrogen of unsaturated lipids. Therefore, the levels of glutathione are of critical importance in tissue injury caused by inorganic grown substances (Ramalingam et al., 2004). Glutathione is a substrate for GPx and GST. Glutathione peroxides catalyses the reaction between GSH and hydrogen peroxide to form water and oxidized glutathione, which is stable. It may be suggested the vermicompost preserves the activity of glutathione which maintains the level of GSH that inhibits lipid peroxidation by reducing the formation of free radicals there by accelerating the repair mechanism and showing significant protective effect in treatment groups of plants (Zaho et al., 2007). Like glutathione, a significant decrease (p<0.001) in vitamin E levels in inorganic fertilizer application plants when compared to control plants. On treatment with vermicompost a significant improved (p<0.001) was observed as comparable to normal plants (Group1).Vitamin E is recycled by a reaction with vitamin C. Vitamin E is the name given to a group of eight fat-soluble compounds a,ß,p,and D-tocopherol,and a,ß,p, D-tocotrienol. The most abundant form of vitamin E is D-tocopherol ,and this is the only form that is active in humans.Unlike other vitamins ,which are involved in metabolic reactions, it appears that the primary role of vitamin E is to act as an antioxidant. As an antioxidant, vitamin E plays a protective role in many organs and systems Vitamin E is incorporated into the lipid portion of cell membranes and other molecules, protecting these structures form oxidative damage and preventing the propagation of lipid peroxidation. Vitamin E is necessary for maintaining a healthy immune system, and it protects the thymus and circulating white blood cells from oxidative damage. Also, it might work synergistically with vitamin c in enhancing immune function. A significant decrease in the concentration of vitamin C was noted in inorganic fertilizer plants. Application of vermicompost brought the level of vitamin C to near normal in vermicompost of plants (Alul et al., 2003).

Vitamin C is a well-known antioxidant, which protects the cell from free radical attack. Vitamin C protects the sulthydryl group from oxidative damage through inhibition of peroxidation of membrane lipids in plants. Vitamin C has been shown to decrease the elevated levels of MDA, conjugated dienes and hydro peroxides in plant tissues of experimental plants. Vitamin C can protect cell membrane and lipoprotein particles from oxidative damage by regeneration of the antioxidants or vitamin E. It imparts its protection by undergoing oxidation of hydroascorbate. For the back conversion to ascorbate, GSH is required. Consequently when GSH is reduced, there is a fall in the levels of vitamin (Borek, 2005).

In the present study, the significant depletion of carotenoids in the plant tissues of inorganic grown plants was observed. However, on application of vermicompost restored the plant carotenoids to normal.

3.1.3 Enzymatic antioxidants in *Andrographis Paniculata*

The changes in the enzymatic antioxidants namely superoxide dismutase (SOD), catalse (CAT) and glutathione peroxides (GPx) in the plant of normal and experimental plants are illustrated in the Table II. From the Table II, The levels of SOD, CAT and GPx were significantly higher in control as compared to inorganic grown plants. Vermicompost application, the activities were reverse to normal. SOD protects tissue against oxygen free radicals by catalyzing the removal of superoxide radical, which damages the membrane and biological structure. Superoxide dismutase play a role in defense mechanism against endogenously generated superoxide anion. Catalase appears to be the most effective defense against high concentration of H2 Superoxide dismutase is an enzyme responsible for dismutation of highly reactive and powerful inorganic grown superoxide to H_2O_2. A reduced activity of this enzyme may reduce its cellular efficacy to detoxify these potentially inorganic grown oxy radicals, which will lead to an increase in the levels of LPO(Chattopadhyay, 2006). Considering these views and also with the assumption that vermicompost application might increases the quantity of enzymatic and non enzymatic antioxidants that might directly be involved in the detoxification of ROS, prevent the damage of tissues imposed by oxidative stress.

IV. CONCLUSION

The study concludes that's vermicompost was cheap, eco-friendly and nutrient rich manure with free of side effects towards the medicinal plant of *Andrographis paniculata*. So, finally we concluded that vermicompost is highly control the growth, plant metabolites and enzymes that are responsible for the metabolism of plant.

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Figure 1. Levels of Non-antioxidant Enzymes

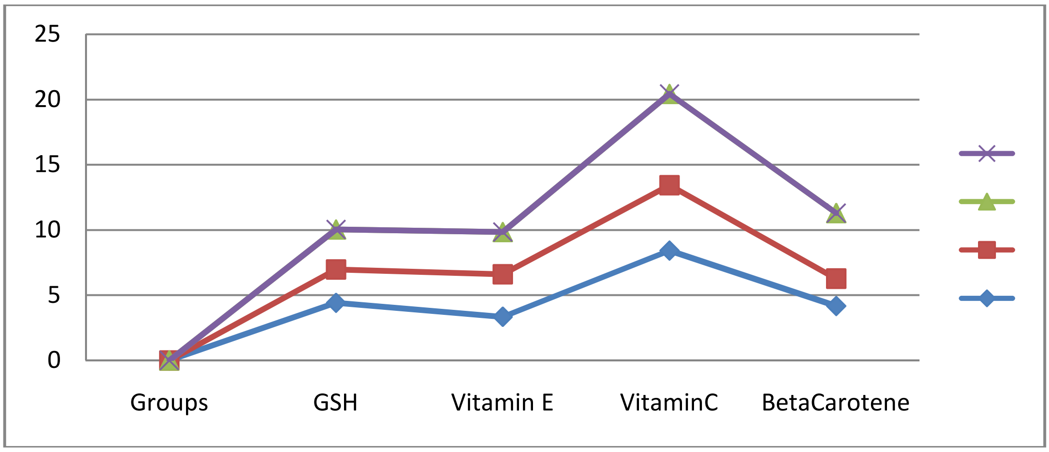

Figure 2. Levels of Antioxidant Enzymes