RESEARCH PAPER | Botany | Volume : 4 | Issue : 6 | June 2014 | ISSN - 2249-555X

Alleviation of Oxidative Damage by Exogenous Application of Plant Growth Regulators on Medicinally Important Oil Yielding Plant Simarouba Glauca Dc. Under Water Stress Conditions.

KEYWORDS: Ascorbate peroxidase, guaiacol peroxidase, IIA oxidase, salicylic acid, putrscine, GABA, abscisic acid.

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ABSTRACT *Drought stress is one of the main environmental factor that causes oxidative damage and adversely affect plant growth and productivity. Strategies to minimize oxidative damage are a universal feature of plant defense responses. Plant growth regulators have antioxidative characteristic that can decrease drought effect. An attempt have been made to identify the response of PGRs like SA (salicylic acid), Putrescine, GABA (Gamma amino butyric acid) and Abscisic acid on ascorbate peroxidase, guaicol peroxidase and IIA oxidase activities of medicinally important oil yielding plant Simarouba glauca DC. under water stress conditions. Increased levels of ascorbate peroxidase, guaiacol peroxidase and IIA oxidase activity were noticed in stressed plants as compared to control plants. Exogenous applications of these PGRs also showed increase in the activities of these antioxidant enzymes as compared to unsprayed stressed plants. These results indicate that SA, Putrescine, GABA and Abscisic acid plays a vital role in drought tolerance by minimizing oxidative damage.*

Introduction:
The quality and quantity of economically important crops through out the world is adversely affected by the abiotic stresses like drought, salinity and extreme temperatures. Crop productivity is mostly limited by drought due to induction of the ROS (Pastori and Foyer, 2002 and Ashraf 2009). The plants are adapted to drought and desiccation due to induction in synthesis of anti-oxidant enzymes (Ingram and Bartels, 1996; Miller et al.,2010; Selote and Khanna-Chopra 2010).

Simarouba glauca an evergreen tree, commonly known as paradise tree. It has long history of herbal medicine having many pharmaceutical properties. It is an edible oil seed bearing, versatile, multipurpose tree which can grow well even in the degradable soils. It can adapt to a wide range of range of temperatures (30-45^{0}c) and altitudes (up to 1000 m above sea levels). PGRs have anti-oxidative characteristic that can decrease drought effect. In the present study an attempt has been made to study the effect of PGRs on antioxidative enzymes under water stress.

Material and methods:
One year old seedlings of Simarouba glauca were raised in earthen pots in polyhouse of Shivaji University Kolhapur. After the settlement of one month, plants were subjected 4, 8, 12 and 16 days water stress. Exogenous applications of PGRs like SA (50 ppm), Putresceine (10 ppm), GABA (10 ppm) and abscisic acid (10 ppm) were given to stressed plants between each stress. The leaves were analysed to find out the activity of antioxidant enzymes like ascorbate peroxidase, guaiacol peroxidase and IAA oxidase. The activity of ascorbate peroxidase and guaiacol peroxidase were determined by using the method suggested by Amako et al,(1994). The method of Tang and Bonner (1947) was followed for analysis of IAA oxidase activity.

Results and Discussion:
Influence of foliar sprays of growth regulators on ascorbate peroxidase (APX) activity is presented in fig. 1. It is observed that APX activity is increased in stressed plants than control plants while stressed plants when sprayed with PGRs shows enhanced APX activity. APX scavenges H_2O_2 in which ascorbate acts as an electron donar in plants. According to Yan et al. (2003) under drought condition over expression of a gene for APX protects the plants against photorespiratory H_20_2 production. Lascano et al. (2001) reported increased APX activity as an adaptive response of wheat seedlings to ROS generated under drought condition. Exogenous application of SA enhances the activity of APX, it was reported by Janda et al.(2003) and Shakirova (2007) in cereal crops.

The effect of foliar sprays of PGRs on guaiacol peroxidase in (GPX) in the leaves of S. glauca under drought stress is shown in fig. 2. Increase in GPX activity in stressed plants was observed as compared to control. Stressed plants when sprayed with PGRs shows more increase in GPX activity. Zhang et al.(1995) reported increase in GPX activity under water stressed condition in maize plant. Sharma and Dubey (2005) observed sharp decline in H_2O_2 conc. under drought conditions in the rice seedling and explained that increased GPX activity , as well as non enzymatic reactions results in lowering H_2O_2. According to Aktas et al.(2007) exogenous application of ABA induces antioxidant enzymes like peroxidases in Lauras nobilis.

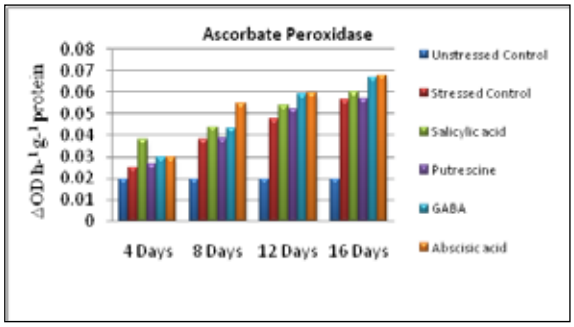
Fig.3 shows the effect of foliar sprays of PGRs on enzyme IAA oxidase enzyme in the leaves of Simarouba glauca under water stress . As compared to control plants water stressed plants showed increase IAA activity . Water stressed plants when sprayed with PGRs shows further increase in IAA oxidase activity than unsprayed water stressed plants. Abdalla and Khoshiban (2007) reported increase in IAA oxidase activity under water stress conditions. The exogenous application of PGRs under stressed conditions ameliorates a water stress by inducing synthesis of antioxidant enzymes, which will protect the membrane damage by reducing peroxidation of membrane. Thus, induction of antioxidant metabolism under water stress conditions reduces the formation of reactive oxygen species. This results in the development of Simarouba glauca plant more stable for water deficit, which will further improve the growth and development of this medicinally important oil yielding tree species. This will found beneficial in future to develop a ecofriendly hard and sturdy plants to reduce green house effects in future.

Acknowledgement
One of the authors (Awate P.D.) is thankful to and Head, Department of Botany Shivaji University, Kolhapur for providing laboratory facilities and also internet and departmental

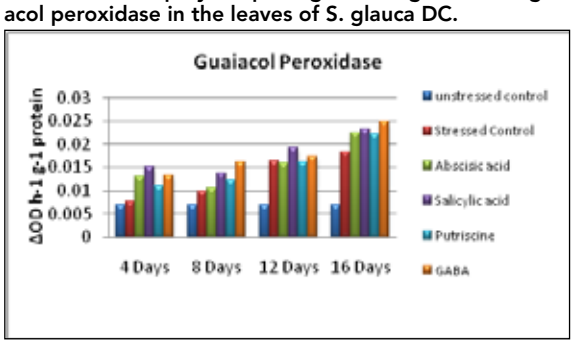
Volume : 4 | Issue : 6 | June 2014 | ISSN - 2249-555X

Library facilities.

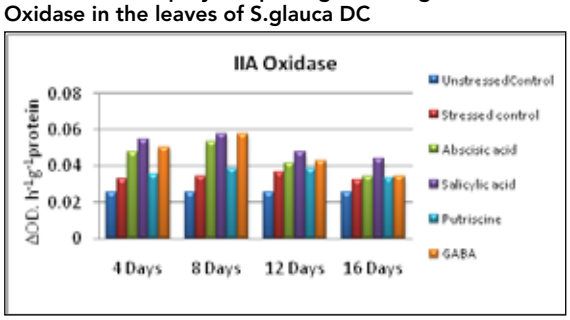
Effect of foliar sprays of plant growth regulators on Ascorbate peroxidase in the leaves of Simarouba glauca DC.



Effect of foliar sprays of plant growth regulators on guaiacol peroxidase in the leaves of S. glauca DC.



Effect of foliar sprays of plant growth regulators on IAA Oxidase in the leaves of S.glauca DC



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