ORIGINAL ARTICLE



Antioxidant enzyme activities in male and female plants of *Hippophae* salicifolia D. Don in different pheno-phases

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Abstract

Changing seasons or environmental condition of a region and various life phases of the yearly cycle of plants can cause the production of reactive oxygen species in plant tissues. The antioxidative system plays a vital role in acclimations in such stress-full conditions, either enzymes or non-enzymatic molecules. Hippophae salicifolia D. Don. is a dioecious and deciduous tree species growing in temperate to the subalpine region of Indian Himalayas in Lahul Spiti (Himachal Pradesh), Uttarakhand, Sikkim, and Arunachal Pradesh. As a dioecious species, variation in male and female was observed in many aspects in both sexual-morph in a range of studies. A hypothesis was made in this study, that male and female plant of H. salicifolia has a different antioxidant potential for quenching the reactive oxygen species in the various growing season of the year, and the antioxidant enzyme activities of male and female also vary with pheno-phases. For this purpose, 10-year-old male and female plants were selected, and leaves and buds were collected from them according to the growing season. Enzymatic extraction was carried out according to the standardized method and enzyme assays were carried out for superoxide dismutase (SOD) and peroxidase (POD). Results showed the variation in SOD and POD enzyme activities in leaves and buds of male and female plants of *H. salicifolia* in different pheno-phases. Female leaves showed highest enzymatic antioxidant activities in the fruit maturation period (September) and lowest during leaf senescence period (November), whereas male leaves showed highest SOD activity in September but highest POD activity in July. Buds showed higher SOD activity, but lower POD activity than the leaves and differences in activity was not significant in dormant buds at gender basis, active buds showed lower SOD activity but higher POD activity in both male and female.

Keywords Dioecious · SOD · POD · Leaves · Buds

Abbreviations

ROS	Reactive oxygen species
SOD	Superoxide dismutase
POD	Peroxidase
EDTA	Ethylene diamine tetraacetic acid
NBT	Nitro-blue tetrazolium

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Introduction

With changing each season, tree species experienced the change in temperature cycles, humidity, daylight interval, etc., which influences vital functions of that tree. Due to freeze-thaw situations in temperate or subalpine regions, plants experienced cold stress, drought, and heat stress. Therefore, to survive those changeable ambient environmental circumstances, plants have to employ different means to guarantee the functions of vital metabolism as well as their seasonal functional cycles properly (Krasensky and Jonak 2012). The consequences of various biochemical and physiological processes taking place in plants to adapt to those harsh conditions lead to the production of different kinds of inhibitory compounds. ROS (superoxide anion radical $-O_2^{\bullet}$ -, hydrogen peroxide— H_2O_2 , and hydroxyl radicals— OH) are very hazardous among those; these are produced as unavoidable byproducts of aerobic metabolism. The life time of active oxygen species within the cellular environment

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