Antioxidant response of *Impatiens walleriana* L. to drought

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**Abstract:** Stress caused by drought induces plant morphology, biochemistry, and physiology changes, leading to considerable reductions in plant growth and productivity. This study aimed to evaluate the antioxidant defence system of impatiens seedlings (*Impatiens walleriana* L.) under drought. The antioxidant response of impatiens to drought was evaluated using following parameters: the activity of catalase, guaiacol peroxidase, pyrogallol peroxidase and ascorbate peroxidase, total phenolic and flavonoids contents and total antioxidant capacity. The experiment was conducted during 2020 in a greenhouse under controlled conditions. Half of the impatiens seedlings (20 plants), after the acclimation period in the greenhouse, were exposed to drought for a period of five days, while the second half was not (20 plants were regularly watered). The results of the study showed that the exposure of impatiens seedlings to drought increased the activity of enzymatic components, total phenolics and flavonoids contents and total antioxidant capacity of leaves. Greater exposure of impatiens to drought (in the observed period) implied a higher plant enzymatic and non-enzymatic antioxidant defence system activity. These results confirm that impatiens has evolved both enzymatic and non-enzymatic antioxidant defence mechanisms to adapt and survive the short-term drought exposure.

**Key words:** defence system; free radicals; leaves; plant growth; stress

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**Antioksidacijski odziv vodenke (*Impatiens walleriana* L.) na sušo**


**Ključne besede:** obrambni sistem; prosti radikali; listi; rast rastlin; stres

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1 INTRODUCTION

Drought is the most important abiotic factor limiting crop productivity. The lack of water in soil reduces the soil water potential and the ability of plants to take up water, resulting in growth inhibition and reproductive failure (Fahad et al., 2017). In addition, the inevitable consequence of drought is an increase in the production of reactive oxygen species (ROS) in plant cells. ROS include free radicals such as superoxide radical, hydroxyl radical as well as non-radical molecules like hydrogen peroxide ($\text{H}_2\text{O}_2$). Increased levels of ROS can cause cellular damage and even cell death (Tola et al., 2021).

Plants, however, have evolved numerous mechanisms to contend with oxidative stress, including the enzymatic and non-enzymatic antioxidant systems. Non-enzymatic defences include compounds with antioxidant properties such as phenolic compounds, vitamin C and carotenoids, while the enzymatic defences include antioxidant enzymes associated with ROS scavenging in plants such as superoxide dismutase (SOD), guaiacol peroxidase (GPX), pyrogallol peroxidase (PPX), ascorbate peroxidase (APX) and catalase (CAT) (Mehla et al., 2017).

SOD protects cells against ROS by catalysing the dismutation of highly toxic superoxide anions to less toxic hydrogen peroxide ($\text{H}_2\text{O}_2$) and molecular oxygen ($\text{O}_2$). After dismutation of the superoxide anions by SOD into $\text{O}_2$ and $\text{H}_2\text{O}_2$, the CAT decomposes the released $\text{H}_2\text{O}_2$ into $\text{H}_2\text{O}$ and $\text{O}_2$ (Berwal & Ram, 2018). GPX and PPX also protect cells against the damaging effect of $\text{H}_2\text{O}_2$ by catalysing their decomposition through oxidation of phenolic substrates (Gill & Tuteja, 2010). APX is also a $\text{H}_2\text{O}_2$-scavenging enzyme. APX utilizes ascorbic acid as specific electron donor to reduce $\text{H}_2\text{O}_2$ to $\text{H}_2\text{O}$ (Hasanuzzaman et al., 2019).

The aim of this study was to evaluate the enzymatic and non-enzymatic antioxidant defence system of impatiens seedlings (Impatiens walleriana L.) under drought stress. Impatiens was selected as subject of this study primarily because the global production of this flowering plant species is consistently increasing. Therefore any new knowledge about the behaviour of these plants, especially under stress conditions, is of great interest to both producers and scientists.

2 MATERIALS AND METHODS

2.1 EXPERIMENTAL CONDITIONS

The experiment was conducted in May 2020 under controlled conditions in the greenhouse of public communal company ‘Park’ in Sarajevo. The temperature in the greenhouse during the experiment was maintained at 24°C/21°C during day/night, while the relative humidity (RH) was maintained between 60% and 70%, with combined venting to reduce RH and fogging systems to increase RH.

In the beginning of the experiment, the impatiens seedlings were in the initial stage of flowering. The first part of the study involved transplanting impatiens seedlings into individual pots (20 cm diameter × 13 cm height), containing substrate Florahum-SP. Impatiens seedlings used in the experiment were produced in the nursery near the greenhouse and showed no significant difference in size and appearance.

Ten days after transplanting, half of the impatiens (20 plants) were exposed to drought for next five days (non-watering). However, the second half was not exposed to drought, they served as controls (20 plants were regularly watered). Leaves of impatiens were sampled at the beginning and at the end of experiment (2nd and 5th day after drought treatment). Each leaf sample consisted of three fully expanded and healthy impatiens leaves. Fresh leaves were cut and immediately frozen with liquid nitrogen and then stored in ultra-freezer at -20°C until further use.

2.2 PROTEIN AND ENZYME ACTIVITY MEASUREMENTS

To obtain the extracts that were used to determine the protein content and activities of catalase and peroxidases, 0.5 g of fresh leaf sample was macerated using a mortar and pestle with liquid nitrogen and 0.015 g polyvinylpyrrolidone (PVP). The powder thus obtained was homogenized in 1.5 ml 50 mM potassium phosphate buffer (pH 7) containing 1 mM dithiothreitol (DTT) and 1 mM ethylenediaminetetraacetic acid (EDTA). The homogenized material was centrifuged at 10,000 g for 10 min at 4°C, and the supernatant was used for protein and enzyme activity measurements.

The extracted proteins were quantified using the Bradford method with bovine serum albumin (BSA) as the standard (Bradford, 1976). The pyrogallol peroxidase (PPX) activity was determined by the oxidation of pyrogallol according to the method of Chance & Maehly (1955) and the results were expressed as μmol purpurrogallin per min per mg protein. The guaiacol peroxidase (GPX) activity was determined by the oxidation of guaiacol according to the method of Chance & Maehly (1955) and the results were expressed as μmol tetraguaiacol per min per mg protein. The ascorbate peroxidase (APX) activity was determined by the oxidation of ascorbic acid...
Antioxidant response of *Impatiens walleriana* L. to drought according to the method of Nakano & Asada (1981) and the results were expressed as µmol ascorbic acid oxidized per min per mg protein. The catalase (CAT) activity was determined by monitoring the decrease in absorbance at 240 nm at an interval of 5 to 120 sec as a result of H$_2$O$_2$ consumption (Aebi, 1984). Results were expressed as µmol of H$_2$O$_2$ consumed per min per mg protein.

### 2.3 EXTRACTION OF PHENOLIC COMPOUNDS FROM LEAVES

The collected fresh leaves of impatiens were oven-dried at 40 °C (3 days) to avoid degradation of their phenolic compounds. After that, dried leaf samples were ground to a fine powder using an electric blender and stored at 4 °C until extraction and analysis. Extraction of phenolic compounds from dried leaf sample was done as follows: 1 g of sample was extracted with 30 ml of 60 % ethanol aqueous solution at room temperature for 24 h. Thereafter, the extract was filtered through Whatman filter paper (11 μm pore size) into 50 ml volumetric flask and diluted to the mark with 60 % ethanol aqueous solution. The extract thus obtained was used to estimate total phenolic content, total flavonoid content and total antioxidant capacity.

### 2.4 TOTAL PHENolics CONTENT

The colorimetric reaction with Folin-Ciocâlтеu reagent was performed to determine the content of phenolic compounds in leaf samples of impatiens (Ough & Amerine, 1988). The reaction mixtures consisted of 0.1 ml of extract, 6 ml of distilled water, 0.5 ml of Folin-Ciocalteu reagent (before use diluted in distilled water 1:2, v/v) and 1.5 ml of 20 % Na$_2$CO$_3$ were mixed thoroughly. Thereafter, the mixture was heated in a water bath at 40 °C for 30 min. After cooling to room temperature, the absorbance of the mixture was read at 765 nm. The results were calculated on the basis of the calibration curve for gallic acid (0-500 mg l$^{-1}$) and were expressed as mg of gallic acid equivalents per g of dry mass (mg GAE g$^{-1}$ DM).

### 2.5 TOTAL FLAVONOIDS CONTENT

The aluminum chloride colorimetric assay was performed to determine the total flavonoid contents (Zhishen et al., 1999). The reaction mixtures consisted of 1 ml of extract, 4 ml of distilled water, 0.3 ml of 5 % NaNO$_2$, 0.3 ml of 10 % AlCl$_3$ and 2 ml of 1 M NaOH were mixed thoroughly. The mixture was made up to 10 ml with distilled water and incubated at room temperature for 1 h, and then the absorbance of the mixture was read at 510 nm. The results were calculated on the basis of the calibration curve for catechin (0-100 mg l$^{-1}$) and were expressed as mg of catechin equivalents per g of dry mass (mg C g$^{-1}$ DM).

### 2.6 FERRic REDUCING AntIOXIDANT POWER (FRAP) ASSAY

Ferric reducing antioxidant power (FRAP) assay was performed to estimate the total antioxidant capacity (Benzie & Strain, 1996). The reaction mixture consisted of 80 μl of extract, 240 μl of distilled and 2080 μl of fresh FRAP reagent were mixed thoroughly. The FRAP reagent was prepared immediately before use by mixing acetate buffer (300 mM, pH = 3.6), 10 mM TPTZ (2,4,6-tri(2-pyridyl)-s-triazine) in 40 mM HCl and 20 mM FeCl$_3$ in a volume ratio of 10:1:1. Thereafter, the mixture was heated at 37 °C for 15 min in a water bath. After cooling to room temperature the absorbance was read at 595 nm. The results were calculated on the basis of the calibration curve for FeSO$_4 \times 7$ H$_2$O (0-2000 μM) and were expressed as µmol of Fe$^{2+}$ per g of dry mass (µmol Fe$^{2+}$ g$^{-1}$ DM). Amersham ultrospec 2100 spectro-photometer (Biochrom, USA) was used for all spectrophotometric measures.

### 2.7 STATISTICAL ANALYSIS

All experimental measurements were done in triplicates and the results were presented as mean ± standard deviation. Pearson correlation coefficient was used to reflect relationship total phenolic, total flavonoids and total antioxidant activities. One-way analysis of variance (ANOVA) and least-significant-difference test (LSD) at 0.05 level of probability ($p < 0.05$) were performed to evaluate statistical significance between the means using Microsoft Excel 2010 software (Office 2010, Redmond, WA, USA).

### 3 RESULTS

The activity of all tested enzymes (GPX, PPX, APX and CAT) in the observed period were higher in leaves of impatiens exposed to drought compared to impatiens grown under standard growth conditions (without stress), as shown in Table 1. The results of this study also showed that the activities of all enzymes were increased with the progress of stress.
The activity of GPX and APX were significantly higher in the leaves of impatiens exposed to drought than in the control, regardless of the duration of plant exposure to stress. However, the activity of PPX and CAT in leaves of all stressed impatiens seedlings was significantly higher only at the end of the experiment i.e. on the fifth day of plant exposure to drought. In controls i.e. in variants where impatiens seedlings were not exposed to drought, the activity of all enzymes tested did not change significantly during the experiment.

In this study, the non-enzymatic antioxidant defence system (total phenolic contents (TPC), total flavonoids (TFC) and total antioxidant capacity (TAC) were also affected by growth conditions (Table 2). As shown in Table 2, TPC, TFC and TAC were higher in the leaves of impatiens exposed to drought than in control. The increases were statistically significant for both the second and the fifth day of plant exposure to drought.

In this study, there was a positive and strong significant relationship between the total phenolic/flavonoids and the total antioxidant capacity of impatiens leaves regardless of growth conditions, indicating that phenolic compounds are mainly responsible for total antioxidant capacity of plants (Table 3).

4 DISCUSSION

A key sign of drought stress at the cellular level is the overproduction of reactive oxygen species (ROS), which is being considered as the most common cause of cellular damage. However, plants have evolved an efficient enzymatic and non-enzymatic antioxidant system to protect themselves against ROS. Within a cell, the SOD constitutes the first line of plant antioxidant defence against ROS. However, H₂O₂, which results from the action of SOD, is toxic to cells. Therefore, the efficient scavenging of H₂O₂ is regarded as a key feature in the cellular antioxidant defence system. Fortunately, plant cells are endowed with H₂O₂-metabolizing enzymes such as peroxidases and catalase. Peroxidases are group of enzymes that catalyse the conversion H₂O₂ into H₂O using a wide variety of substrates as an electron donor (Abedi & Paknyat, 2010).

In this study, generally, stress caused by drought increased the CAT and peroxidase enzymatic activity, and the increase was in line with stress duration; greater exposure of impatiens to drought (in the observed period) implied a higher activity of antioxidant enzymes. However, there was a differential level of activity among enzymes. The activities of GPX and APX enzymes at the early stage of drought stress (2nd day after drought treatment) were significantly higher as compared to CAT, although both peroxidases and CAT act on the same substrate (H₂O₂). Lower CAT activities in plants at the early stage of stress have been reported in many studies (Chugh et al, 2013; Antonić et al., 2016; Wang et al., 2019). Smirnov & Araound (2019) noted that CAT does not have a high affinity for H₂O₂ and this is probably one of the main reasons for its low activity. However, CAT has...
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The antioxidant defence mechanisms depend on each phenolic compound’s chemical structure. Among the phenolic compounds with known antioxidant activity, flavonoids are highlighted (Dibacto et al., 2021). In this study, TFC in leaves of impatiens were progressively influenced by drought. An increase in TFC in leaves of impatiens was already recorded in the 2nd days after drought treatment, and with the progress of stress (5th days after drought treatment), TFC was gradually increased. In this study, an increase of TFC was in line with increase of TPC in impatiens leaves regardless of growth conditions. This was expected since the flavonoids are the biggest group of phenolic compounds.

In the present study, the total antioxidant capacity level estimated with FRAP assay was also significantly higher in leaves of impatiens exposed to drought than in controls. Furthermore, the present study indicates a very strong relationship between the TPC/TFC and TAC in leaves of impatiens, regardless of growth conditions. In short, the antioxidant activity in leaves of impatiens increased by increasing the total phenolic and flavonoid contents. These results were also expected since it is known that phenolic compounds are among the most potent antioxidants from plants.

The levels of enzymatic and non-enzymatic antioxidants in impatiens leaves were very high in the fifth day after drought treatment. Accumulation of these antioxidants suggests a high level of stress convened to the impatiens during this period (Sharma et al., 2012). It can also be assumed that the impatiens during this period continues to defend itself against ROS by producing a high amount of enzymatic and non-enzymatic antioxidants (Kim et al., 2014). However, numerous studies reported a decline in the activity of antioxidant enzymes in various plants in the final stage of stress (three days or more after exposed plant to stress), indicating that antioxidant capacity and thus drought tolerance can vary among plants (Almeselmani et al., 2006; Sabzmeydani et al., 2021). It is evident that plant response to drought depends not only on the extremity and time duration of the stress but also on the plant genetic background.

### 5 CONCLUSIONS

Exposure of impatiens seedlings to drought increased the activity of enzymatic antioxidants, total phenolic and flavonoid contents and total antioxidant capacity of leaves. Greater exposure of impatiens to drought (in the observed period) implied a higher activity of plant enzymatic and non-enzymatic antioxidant defence systems. These results confirm that impatiens have evolved both enzymatic and non-enzymatic antioxidant response to drought.

### Table 3: Pearson’s correlation between total phenolic (TPC), total flavonoids (TFC) and total antioxidant capacity (TAC)

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Braunschweig Enzyme Database (BRENDA) reports that one molecule of catalase can convert over 2.8 million molecules of hydrogen peroxide to water and oxygen per second (Schomburg et al., 2017). Therefore, CAT is a sink for $H_2O_2$ and is indispensable for plant defence system against oxidative stress (Willekens et al., 1997).

Besides enzymatic antioxidants, plants synthesize a wide range of non-enzymatic antioxidants capable of decreasing ROS-induced oxidative damage (Kasote et al., 2015). Non-enzymatic antioxidants include vitamin C, vitamin E, phenolic compounds, carotenoids, etc. Among all non-enzymatic antioxidants, phenolic compounds appear to be the most important since they have a great potential to clear ROS. The antioxidant properties of phenolic compounds are mainly due to their high redox potential, allowing them to act as reducing agents, hydrogen donors or singlet oxygen quenchers (Liang et al., 2010).

In the present study, the accumulation of phenolic compounds was significantly higher in leaves of impatiens exposed to drought than in controls (without stress). Moreover, an increase in phenolics contents was more significant in impatiens exposed to drought for longer duration. These results suggest that plant initiates the intensive synthesis of phenolic compounds as a response to drought, and this hypothesis has been confirmed by many other scientists (Basu et al., 2010; Cramer et al., 2011; Šamec et al., 2021).

Sharma et al. (2019) reported that the considerable accumulation of phenolic compounds in plants is usually a consistent feature of non-enzymatic antioxidant defence mechanisms under stress. However, the capacity of antioxidant defence mechanisms depends on each phenolic compound's chemical structure. Among the phenolic compounds with known antioxidant activity, flavonoids are highlighted (Dibacto et al., 2021). In this study, TFC in leaves of impatiens were progressively influenced by drought. An increase in TFC in leaves of impatiens was already recorded in the 2nd days after drought treatment, and with the progress of stress (5th days after drought treatment), TFC was gradually increased. In this study, an increase of TFC was in line with increase of TPC in impatiens leaves regardless of growth conditions. This was expected since the flavonoids are the biggest group of phenolic compounds.

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defence mechanisms to adapt and survive the short-term drought exposure.

6 REFERENCES


Schomburg, I, Jeske, L, Ulbrich, M, Placzek, S., Chang, A., Schomburg, D. (2017). The BRENDA enzyme informa-
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