

Effect of foliar spray with putrescine and proline on some physiological characteristics of peel and pulp of two *Citrus* species in response to low temperature stress

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Abstract

Different species of *Citrus* are sensitive to low temperature stress. Today plant growth regulators are used to reduce the negative effects of stress on plants. In this study, physiological and biochemical changes in the peel and pulp of *Citrus* fruits treated with different concentrations of putrescine and proline under low temperatures were investigated. The selected branches were sprayed with putrescine (0, 5 and 10 mM) and proline (0, 15 and 20 mM), 24 hours before exposure to low temperatures. Then, the treated bearing branches were exposed to temperatures of +1, -1 and -3 °C for three hours. Results of the study indicated that in control trees of both *Citrus* species, low temperature decreased the rate of reduction in sugars concentration, while the amounts of phenolic compounds, flavonoids and soluble solids in peel and pulp of both *Citrus* species were increased. The amount of phenolic compounds, flavonoids and soluble solids increased in fruits treated with proline and putrescine compared to control. The highest amounts of these parameters were observed in samples treated with proline at 20 mM and putrescine at 10 mM.

Keywords: *Citrus* species, Flavonoid, Low temperature stress, Reducing sugars, ROSs

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Investigation on morphological characteristics, yield and nutrient contents in the leaves of 11 olive cultivars grown in Tarom region

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Abstract

Environmental stresses are of main factors affecting the olive cultivation programs in arid regions. Morphological and functional characteristics and the amount of leaf nutrients in 11 cultivars of olive (Zard, Roghani, Voliotiki, Arbequina, Karidolia, Oblonga, Amigdalolia, Koroniki, Leccino, Conservolea and Korfolia) grown in Tarom region under saline conditions and irrigation with salty water were studied. The results showed that, the cultivars were different in morphological traits (number of inflorescences on branches, number of flowers in inflorescences, the number of fruits per branch, the final number of fruits on the branches, chlorophyll index) and leaf nutrient contents (boron, copper, zinc, manganese, iron, potassium, phosphorus, nitrogen, sodium, chlorine). The highest fruit number was recorded in Arbequina (8.66), Korfolia (7.33), respectively and the lowest amount was recorded in Roghani (1.66), Zard (3.33) and Karidolia (3.33), respectively. The results showed that Koroniki and Amigdalolia cultivars contain less amounts of sodium and chlorine in their leaves, which is probably due to the resistance of these cultivars to salinity conditions and can be taken into consideration for salinity resistance.

Keywords: Chlorine, Final fruit, Olive, Salt stresses, Sodium

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Influence of humic acid on some antioxidant enzymes activity and compatible metabolites in strawberry (*Fragaria × ananassa* Duch. cv. Sabrina) under salinity stress

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Abstract

Salinity is one of the most brutal environmental factors limiting the productivity of agricultural crops. Very few researches have been conducted regarding the effects of humic acid on plants under salinity conditions. In order to determine the effects of humic acid on some morphological and physiological characteristics of strawberry (*Fragaria × ananassa* Duch. cv. Sabrina) under salinity stress, a greenhouse experiment was conducted with three factors including two treatment methods (spray and drench), three humic acid levels (0, 300 and 600 mg L⁻¹) and three salinity levels (0, 20 and 40 mM) in a completely randomized design with four replications. Results indicated that with increase in salinity levels, soluble sugars and total protein concentrations were increased. At salinity level of 40 mM, application of 600 mg L⁻¹ humic acid, increased soluble sugars, catalase and guaiacol peroxidase enzymes activity about 3.8, 4.1 and 4.5 times than the control, respectively. According to the results of this study, the adverse effects of NaCl stress in strawberry cv. Sabrina were ameliorated by the exogenous application of humic acid (spray and drench).

Keywords: Antioxidant enzymes, Hydroponic culture, Proline, Soluble sugars, Strawberry

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Effect of culture medium pH and sucrose concentration on *in vitro* pollen germination in different cultivars of date palm (*Phoenix dactylifera* L.)

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Abstract

In vitro germination of pollen grains is applied for determination of pollen viability. This study was carried out to evaluate the effect of different levels of pH (4.7, 5.7, 6.7 and 7.7) and sucrose (0, 6, 10, 14 %) separately on *in vitro* pollen germination in four cultivars of date palm (Vardi, Red Ghannami, Sabz Parak and Pakotah). The experiment was carried out as a factorial based on completely randomized design with three replications. The results showed that with increase in culture medium pH, the pollen germination rate of date palm cultivars was increased from 4.7 to 6.7, however, the germination of pollen was decreased in higher pH (7.7). The lowest and highest pollen germination rates were observed in Red Ghannami (73.6 %) and Sabz Parak (57.3 %) under optimum pH condition (6.7), respectively. The effect of sucrose concentration was significant on pollen germination of cultivars. The highest pollen germination percentage was achieved with 6 % sucrose concentration in all cultivars. However, 10 % and 14 % sucrose resulted in a reduced pollen germination. Pakotah cultivar showed highest pollen germination percentage in medium containing 6 % sucrose.

Keywords: Date palm, *In vitro* culture, Pollen germination

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Effect of postharvest application of chitosan coating containing green tea extract on quality characteristics and shelf life of Selva strawberry cultivar

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Abstract

Strawberries are one of the most susceptible fruits to spoilage, mechanical damages and physiological deterioration and have a high rate of metabolism during storage. In this study, chitosan (1%) containing different concentrations of green tea extract (10, 20 and 30 %) was used as a coating for Selva strawberry fruits. Quality parameters including weight loss, pH, acidity, soluble solids, total anthocyanins, texture, color parameters (Lab), microbial count (total bacteria, molds and yeasts) and sensory attributes were assessed during 16 days of storage at 4 °C. Weight loss, pH, soluble solids, total bacteria, molds and yeasts extension were increased, and acidity, total anthocyanin and firmness were decreased during storage. Strawberries coated with chitosan containing green tea extract had a lower weight loss, pH, soluble solids and higher acidity, total anthocyanin, and firmness than control. The results showed that coating Selva strawberry fruit with chitosan containing green tea extract improved color parameters and decreased microbial count during storage. Increase in the concentration of green tea extract resulted in synergistic effects with chitosan, so that 1% chitosan coating containing 30% green tea extract showed the highest effects in improving quality attribute and extending the shelf life of fruits.

Keywords: Chitosan, Coating, Green tea extract, Quality characteristics, Shelf life, Strawberry

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Effect of Zn-oxide nanoparticles coating on physicochemical properties, enzymatic activity and storage life of sweet cheery cv. Takdaneh Mashhad (*Prunus avium* L.)

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Abstract

Sweet cherry fruit (*Prunus avium* cv. Takdaneh Mashhad) is susceptible to decay and has short storage life. In present study, the efficacy of Zn-oxide nanoparticles as an edible coating for increasing the storage life of sweet cherry was investigated. The sweet cherry fruits were treated with Zn-oxide nanoparticles at 0, 0.03, 0.06 and 0.09 % concentrations (W/V) and transferred to a cold storage at 2 ± 1 °C and 90 ± 5 % R.H. Fruit quality attributes such as pH, total acidity, soluble solids, decay index, total phenol and ascorbic acid and phenylalanine ammonialyase (PAL) activity were evaluated every fifteen days in four replicates. Zn-oxide nanoparticles treatment reduced fruit decay index compared to control fruits, so that the least amount was observed in 0.9% Zn-oxide nanoparticles treatment on day 15 after harvest. In treated fruits, the activity of PAL was significantly higher. Phenolic content of the treated fruits was increased compared to the control fruits. It can be concluded that coating the sweet cherry fruit with Zn-oxide nanoparticles as safe compound can increase the storage life in a cold storage up to 30 days.

Keywords: Phenol, Phenylalanine ammonialyase (PAL), Shelf life, Sweet cherry (*Prunus avium* L.), Zn-oxide nanoparticles

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Genetic variation in *Crataegus* accessions based on internal transcribed spacer sequences of nuclear DNA

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Abstract

The genus *Crataegus* L. (Hawthorn) belongs to the Rosaceae family. Iran is one of the biodiversity centers of *Crataegus* and there are more than 27 species in Iran. Due to its positive effects on the cardiovascular system, hawthorn has recently become a popular herbal medicine in phytotherapy. This study was carried out in order to examine the genetic diversity of hawthorn in 56 accessions based on internal transcribed spacer (ITS) regions. The accessions belonged to several species including; *C. pentagyna*, *C. pseudomelanocarpa*, *C. monogyna*, *C. meyeri*, *C. songarica*, *C. azarolus* var. *aronia*, *C. azarolus* var. *pontica*, *C. curvisepala*, *C. pseudoheterophylla*, *C. szovitisii*, *C. persica*, *C. arosanguinea*, *C. orientalis*, *C. sakranensis* and *C. turkestanica*. We constructed a phylogenetic tree based on ITS sequence data. Result showed that DNA sequencing is a good tool for species identification and estimation of genetic distance. In Iran, the only species of Sect. *Crataegus* is available in five serieses Ser. *Pentagynae*, Ser. *Erianthae*, Ser. *Orientalis*, Ser. *Microphyllae* and Ser. *Crataegus*. In this study, except Ser. *Microphyllae* other series were detected. Based on the results obtained with the MEGA6 software, in the first branch of the phylogenetic tree the series Ser. *Orientalis* was seen. The Ser. *Pentagynae* and Ser. *Erianthae* were in second branch, and the ser. *Crataegus* were located in the third and fourth branches. This is the widest study about hawthorn genetic variation in Iran.

Keywords: Hawthorn, ITS sequences, Rosaceae family, Sequencing

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