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Effects of Different Concentrations of Selenium on Antioxidant Enzyme Activity of *Pterocypsela laciniata*

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Abstract: The effect of different selenium concentrations on the antioxidant enzyme activity of *Pterocypsela laciniata* was studied by pot experiment. The results showed that the effects of different selenium treatments on *P. laciniata* were significant. With the increase of selenium concentration, the trend of SOD, POD, CAT activities and soluble protein content showed a significant difference. When the concentration of selenium was 25 mg·kg^{-1}, the activities of SOD, POD and CAT of *P. laciniata* was the largest, and the content of soluble protein also reached the peak value. The results showed that selenium treatment could improve the activities of SOD, POD, CAT and soluble protein content of *P. laciniata*. When the selenium concentration was 25 mg·kg^{-1}, the effect was best.

Introduction

Adversity is a general term for all kinds of environmental factors that are harmful to plant growth and survival [1]. Under stress, the number of reactive oxygen species in plants increases dramatically, the activity of antioxidant enzymes in plants increases rapidly, and plays an important stress response to the scavenging of reactive oxygen species. It has become an important monitoring indicator of plant stress response under environmental stress [2]. Selenium is a necessary trace element for humans and animals. It has antioxidant functions in plants [3]. The study shows that selenium has a double effect on the organism, and the low concentration of selenium has antioxidation in the plant. When the concentration of selenium is too high, the activity of antioxidant enzymes is inhibited and selenium is toxic to plants [4-5].

Pterocypsela laciniata is a perennial herb of *Pterocypsela*. It not only has good flavor, delicate texture and high nutritional value, but also plays an important role in anti-tumor, anti-oxidation, anti-cardio cerebrovascular disease and so on. It can be used as a vegetable and can also serve as a good health care product for people [6]. Through agricultural bioaugmentation to obtain selenium enriched agricultural products is an effective way to supplement selenium for human body [7]. In this experiment, *P. laciniata* was cultivated in the soil containing different concentrations of selenium. The effects of different selenium concentrations on the activity of *P. laciniata* antioxidant enzyme were studied in order to find new selenium rich vegetables from wild vegetables and provide reference for the development of wild vegetables.

Materials and Methods

Materials. The seeds of *P. laciniata* were collected near the Chengdu Campus of Sichuan

Agricultural University. After the seedling in the laboratory, at the end of March 2018, the seedlings with better growth and better consistency were transplanted to the pot.

Experimental Design. The soil was taken from the farmland soil near the Chengdu Campus of Sichuan Agricultural University. After the soil was dried, crushed and screened by 5 mm, 3.0 kg soil was put into the plastic basin of 15cm × 18 cm (high × diameter). Selenium is added to the soil in the form of Na_2SeO_3 solution and fully mixed. Keep the soil moist, place 60 days, mix the soil regularly and make the soil mix well. The selenium concentration in soil was 0, 5, 10, 25, 50, 75 and 100 mg·kg^{-1} respectively. The seedlings were transplanted into the basin after breeding in the laboratory. 4 plants were planted in each pot, and four seedlings were scattered in the basin. Each treatment was planted with 6 pots (6 replicates). The distance between the basins is 10 cm, and it is completely arranged at random. During the whole growth process of *P. laciniata*, water was kept daily to maintain the field capacity of about 80% of the soil in the basin and to remove other weeds and pests in time. After 50 days of cultivation, the young leaves of each *P. laciniata* were selected to determine their antioxidant enzyme activities. The content of soluble protein, the activity of POD, the activity of superoxide dismutase (SOD), and the activity of catalase (CAT) by ultraviolet spectrophotometry were determined by Coomassie brilliant blue G-250 method [8].

Statistical Analyses. Statistical analyses were conducted using statistical software of SPSS 17.0. Data were analyzed by one-way ANOVA with least significant difference at 5% confidence level.

Results and Discussion

POD Activity of *P. laciniata.* The effect of selenium treatment on the POD activity of *P. laciniata* was significant (Fig. 1). With the increase of selenium concentration, the activity of POD first increased and then decreased. When the concentration of selenium was 25 mg·kg^{-1}, the activity of POD reached the peak. In the range of 5-75 mg·kg^{-1}, the activity of POD increased significantly, which was increased by 27.42%, 138.77%, 313.45%, 61.07%, 27.22%, respectively. There was no significant difference in POD activity between 100 mg·kg^{-1} and control group.

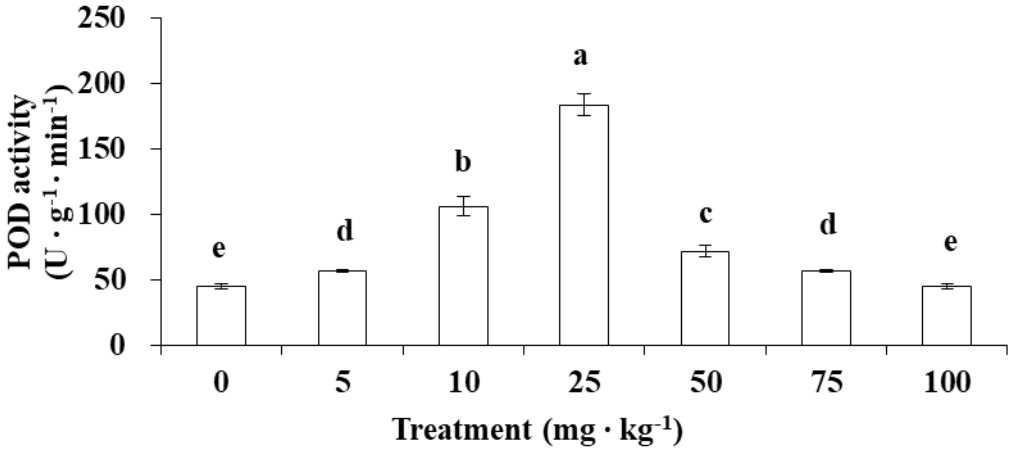

Fig. 1 POD activity of *P. laciniata.*

SOD Activity of *P. laciniata*. With the increase of selenium concentration, the activity of SOD increased first and then decreased (Fig. 2). In the range of 5-25 mg·kg^{-1}, SOD activity increased by 5.33%, 6.73%, 7.71% compared with the control. In the range of selenium concentration 50-100 mg·kg^{-1}, SOD activity decreased significantly compared with the control, decreased by 10.17%, 25.55%, 38.17% respectively.

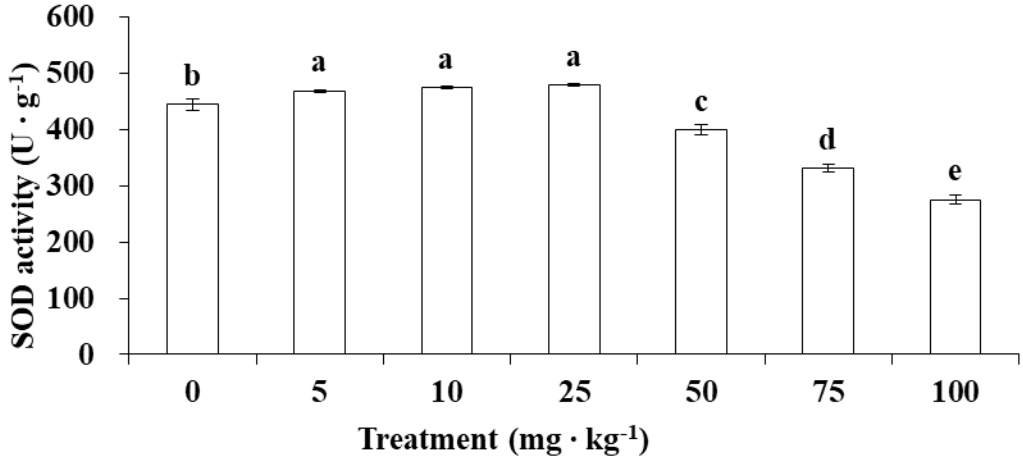

Fig. 2 SOD activity of *P. laciniata.*

CAT Activity of *P. laciniata.* Under Se treatment, CAT activity was significantly different, and CAT activity increased first and then decreased (Fig. 3). When the concentration of selenium was 25 mg·kg^{-1}, the activity of CAT was the highest. When selenium concentrations were 5, 10, 25 and 50 mg·kg^{-1}, CAT activity increased significantly compared with the control, increasing 23.03%, 28.02%, 35.39%, 20.83%, respectively. When the concentrations of selenium were 75 and 100 mg·kg^{-1}, CAT activity decreased significantly compared with the control, decreased by 11.13% and 19.38%.

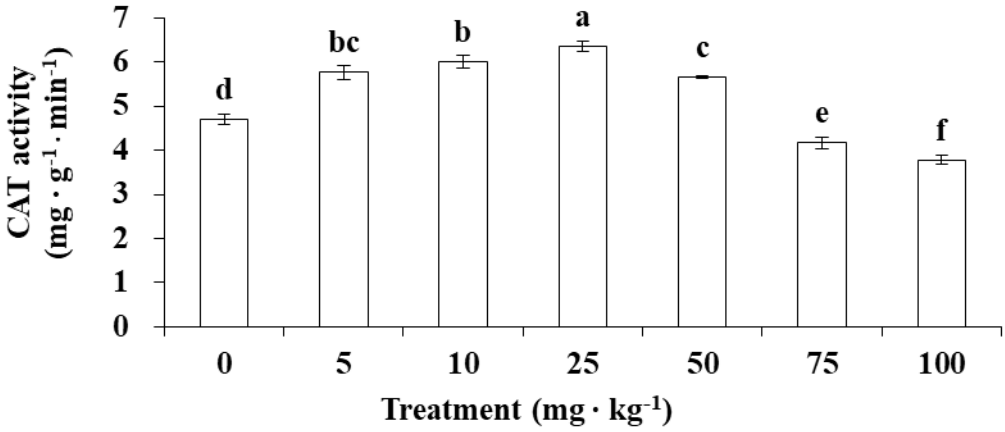

Fig. 3 CAT activity of *P. laciniata.*

Soluble Protein Content of *P. laciniata.* With the increase of selenium concentration, soluble protein content first increased and then decreased (Fig. 4). When selenium concentrations were 5, 10 and 25 mg·kg^{-1}, the soluble protein content increased by 7.03%, 14.74%, 18.28% compared with the control. When Se concentration was 100 mg·kg^{-1}, the soluble protein content decreased by 28.71% compared with the control. The content of soluble protein in other treatments was not significantly different from that in the control group.

Conclusions

The effects of different selenium treatments on *P. laciniata* were significant. With the increase of selenium concentration, the trend of SOD, POD, CAT activities and soluble protein content showed a significant difference. When the concentration of selenium was 25 mg·kg^{-1}, the activities of SOD,

POD and CAT of *P. laciniata* was the largest, and the content of soluble protein also reached the peak value. The results showed that selenium treatment could increase the activities of SOD, POD, CAT and soluble protein content of *P. laciniata*, when the concentration of selenium was 25 mg·kg^{-1}, the effect was the best.

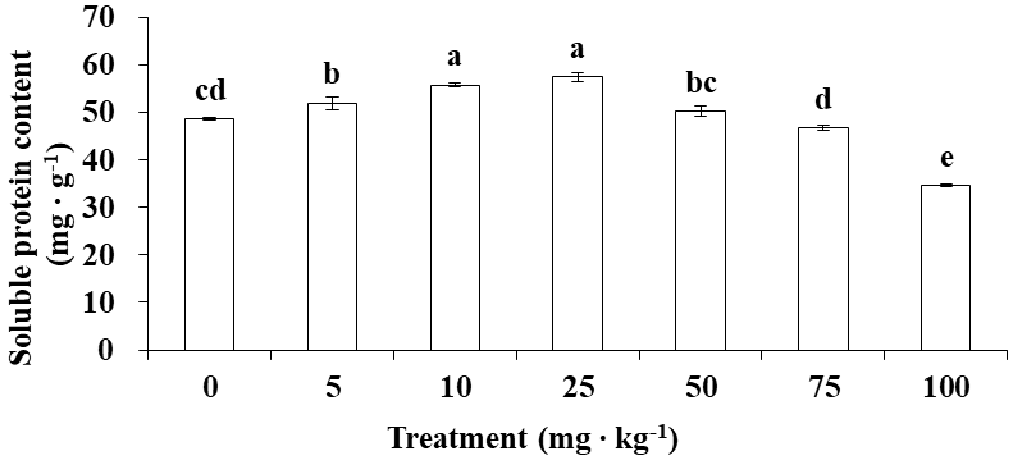

Fig. 4 Soluble protein content of *P. laciniata*

Acknowledgements

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