

研究论文

外来入侵种飞机草在不同环境胁迫下抗氧化酶系统的变化

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收稿日期 2006-7-26 修回日期 2006-9-10 网络版发布日期: 2006-11-25

摘要 飞机草(*Eupatorium odoratum*)原产于中南美洲,在我国最早发现于1934年,目前已经分布到云南、海南、台湾、广东等省区,是一种典型的外来入侵种。研究其在逆境条件下的生理适应机制对于有效治理该入侵种具有十分重要的意义。研究了其在不同环境胁迫条件(高温、低温和干旱)下抗氧化酶系统的变化。结果表明:超氧化物歧化酶(SOD)、抗坏血酸过氧化物酶(APX)和脱氢抗坏血酸还原酶(DHAR)在3种环境胁迫下酶活性都升高;过氧化氢酶(CAT)在高温胁迫下升高,而在低温和干旱胁迫下酶活性降低;过氧化物酶(POD)和单脱氢抗坏血酸还原酶(MDAR)在高温和干旱胁迫下酶活性升高,而在低温胁迫下酶活性降低;谷胱甘肽还原酶(GR)在高温和干旱胁迫下酶活性升高,而在低温胁迫下保持不变。这些研究结果可能有助于寻找一条控制飞机草的新途径。

关键词 [飞机草](#); [抗氧化酶](#); [入侵植物](#); [环境胁迫](#)

分类号 [Q948](#)

Activity of antioxidant enzymes in the invasive plant *Eupatorium odoratum* under various environmental stresses

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Abstract *Eupatorium odoratum*, native to the neotropics from the eastern USA to northern Argentina, has become a major invasive plant of crops, plantations, savannas and natural forests in many parts of the world. In China, *E. odoratum* was first recorded in the southern part of Yunnan Province in 1934. Since then, it has spread extremely rapidly, now it can be found in Yunnan, Guangdong, Guangxi, Hainan, Guizhou, Taiwan provinces, Macao and Hongkong cities, posing threat to local diversity and economics. It is extremely difficult to control or eradicate *E. odoratum*. Considerable effort is being put forward to find new and innovative methods for integrative management of this plant. Knowledge of the physiological response such as changes of activity of enzyme systems in stressful environments is very useful in determining the invasive mechanism of this plant, and consequently could be exploited in as yet unknown ways to devise comprehensive approaches to manage it. In this paper, the activities of antioxidant enzymes, which are crucial in plant's defense against stresses, were studied in *E. odoratum* under various environmental stresses. This information can improve our understanding of the physiological mechanisms of this plant's success as an invader, and may assist in the development of an effective management strategy of this plant. Stresses imposed on *E. odoratum* were heat, cold, drought. For the heat treatments, temperature was increased stepwise from 25 °C to 30, 35, 38 and finally to 42 °C. For the cold treatments, temperature was decreased stepwise from 25 °C to 20, 15, 10 and finally 5 °C. Plants were kept in the growth chambers for 24 h at each temperature step. For the drought treatments, the plants were deprived of water for 4 days. The three stresses induced oxidative damage as evidenced by an increase in lipid peroxidation. In *E. odoratum*, the lesser degree of membrane damage (as indicated by low MDA content) and the coordinated increase of the oxygen-detoxifying enzymes were observed.

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d in heat-treated plants, However, the activities of catalase (CAT), guaiacol peroxidase (POD), ascorbate peroxidase (APX), glutathione reductase (GR) and monodehydroascorbate reductase (MDAR) were not accompanied with increased SOD during cold stress. This indicated that the plant has a higher capacity for scavenging oxygen radicals in heat stress than in cold stress. The activity of superoxide dismutase (SOD), APX and dehydroascorbate reductase (DHA R) increased in response to all stresses. CAT decreased in response to cold and drought but increased when exposed to heat. POD and MDAR activities increased in response to heat and drought but decreased in response to cold. GR activity increased in response to heat and drought, but was not significantly different from the controls in response to the cold stress. These results might help to devise innovative approaches to control the spread of this invasive plant.

Key words Eupatorium odoratum _ antioxidant enzymes _ invasive plant _ stress

DOI

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