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低温胁迫对番茄光合特性及抗氧化酶活性的影响 (PDF)

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Title: Effects of low temperature stresses on photosynthetic characteristics and activity of antioxidant enzymes of tomatoes

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摘要: 根据番茄对低温的反应,于2010年10月-2011年3月间,设计了人工控制试验系统以研究低温胁迫(5℃,7℃,9℃,11℃)对设施番茄光合色素含量、最大光合速率、叶绿素荧光参数、抗氧化酶活性的影响,为设施番茄低温致灾气象指标的确定提供依据。结果表明:不同低温胁迫下叶绿素a,Chla/Chlb和最大光合速率均存在不同程度的降低,而叶绿素b和类胡萝卜素含量则有所升高。低温5℃处理3 d和7℃处理4 d后番茄最大光合速率均为负值,经过25℃恢复5 d后仍无显著升高;低温9℃、11℃胁迫下番茄最大光合速率随处理天数的增加而降低,且经过5 d的恢复处理后最大光合速率可以基本恢复至正常水平。叶绿素荧光参数分析表明,低温胁迫降低了PSII的原始光能转换效率和潜在活性,番茄的 F_v/F_m ,qP,ETR均显著降低,且随胁迫温度和胁迫时间的不同, F_v/F_m ,qP,ETR的变化程度有所不同。不同低温胁迫使得番茄SOD,POD,CAT,MDA酶的活性均有不同程度升高,且温度越低,处理时间越长,升高幅度越大。因此,低温5℃处理3 d或者低温7℃处理4 d是番茄发生严重冷害的临界指标,该研究结果可为作物低温灾害防御及气象灾害预警提供参考。

Abstract: Based on the responses of tomatoes to low temperatures, artificial control tests

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were designed to study the effects of low temperature stresses(5℃,7℃,9℃,11℃) on photosynthetic pigment content, maximum photosynthetic rate, chlorophyll fluorescence parameters and activity of antioxidant enzymes, to provide a basis for the determination of meteorological indices of damage to tomatoes caused by low temperatures. Results show that: chlorophyll a, Chla/Chlb and maximum photosynthetic rate all get some level of reduction, while chlorophyll b and carotenoids content get some level of increase. The maximum photosynthetic rate of tomatoes is negative after processing up to 3 days at 5 ℃ and up to 4 days' at 7 ℃, and it does not have significant rise after recovering 5 days under 25 ℃; while the maximum photosynthetic rate decreased with the increase of processing days at 9 ℃, 11 ℃, and it could basically recover to normal level after 5 days' processing. Chlorophyll fluorescence parameters analysis shows that, low temperature stresses reduce the original light conversion efficiency of the PSII and its potential activity, and F-v/F-m, qP, ETR of tomatoes all decrease significantly, and F-v/F-m, qP, ETR vary with processing temperatures and times. Different low temperature stresses all make the activity of SOD, POD and CAT, MDA increase some degree, and the lower the temperature is, and the longer the processing time is, the greater the activity level rise. Therefore, processing up to 3 days at 5 ℃ or processing up to 4 days at 7 ℃ is the critical index of serious chilling injury happening. The study results could provide a reference to the defense of low temperature disasters of crops and the warning of meteorological disasters.

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