

研究论文

# 不同生育期水稻耐冷性的鉴定及耐冷性差异的生理机制

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收稿日期 2004-12-27 修回日期 2005-3-25 网络版发布日期 接受日期

**摘要** 以粳稻9516、H45、武育粳、转PEPC基因水稻、Kitaake、苏沪香粳, 籼稻扬稻6号、香粳、IR64, 培矮64 S以及杂交稻粤优938、汕优63、X07S/紫微100、两优培九等14个水稻品种为材料, 分别鉴定了芽期(胚根1 cm, 胚芽0.5 cm)、苗期(三叶)和孕穗期的耐冷性, 同时选取南京对水稻播种敏感的自然低温条件, 进行低温鉴定。结果表明, 芽期存活率、苗期的枯死率和孕穗期结实率均为可靠的水稻耐冷性鉴定指标。进一步从叶片的光合速率、PS II 光化学效率(Fv/Fm)、脂肪酸组分、活性氧指标(丙二醛、过氧化氢和超氧阴离子)和抗氧化物质(抗坏血酸和谷胱甘肽)的变化等方面, 研究耐冷性不同的水稻的耐冷生理机制。表明耐冷的水稻品种武育粳含较多的不饱和脂肪酸, 在低温逆境下, 膜的流动性愈大, 低温对其伤害愈小; 对杂交稻汕优63而言, 其叶内抵御逆境的保护系统抗坏血酸和谷胱甘肽的循环被较大地激活, 特别是谷胱甘肽再生的高速运转, 与不耐冷的品种香粳相比, 汕优63叶内的过氧化物物质累积较少, 其耐冷性表现中等。看来水稻叶片维持高的脂肪酸不饱和指数和谷胱甘肽的周转循环能力是水稻耐冷的重要特征。

**关键词** [水稻](#) [耐冷性](#) [生理基础](#)

**分类号** [S511, Q945. 11](#)

## Identification for Cold Tolerance at Different Growth Stages in Rice (*Oryza sativa* L.) and Physiological Mechanism of Differential Cold Tolerance

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**Abstract** To elucidate the physiological mechanism of differential cold tolerance in rice, japonica rice cultivars 9516, H45, Wuyujing, PEPC transgenic rice, Kitaake, Su huxiangjing; indica rice cultivars Yangdao 6, Xiangxian, IR64, Peiai64S and hybrid rice cultivars Yueyou 938, Shanyou63, X07S/Zihui 100, Liangyou Peijiu, 14 rice cultivars were appraised for cold tolerance at early seedling stage, seedling stage (3 blade) and booting stage, respectively (Table 1). At the same time, the identification of cold tolerance in rice in natural chilling condition was conducted in Nanjing (Fig.1). Results showed that the method for identifying cold tolerant rice cultivars at bud stage, seedling stage and booting stage is feasible and bud livability, seedling mortality and seed-setting rate of rice are reliable indexes for cold tolerance identification which are correlated with some physiological parameters in different rice cultivars under chilling treatment. Furthermore, photosynthetic rate (Fig.3), PS II photochemical efficiency (Fv/Fm) (Fig.4), the composition of fatty acid (Table 2), the changes of active oxygen index (MDA, H<sub>2</sub>O<sub>2</sub> and O<sub>2</sub><sup>-</sup>) and anti-photooxidative substance (ascorbate and glutathione) (Table 3) of cultivars with a different tolerance to chilling were studied before and after chilling treatment. The results showed that photosynthetic rate and PS II photochemical efficiency (Fv/Fm) in leaves of tolerant cultivar Wuyujing were kept stable, while those in the sensitive one, Xiangxian, decreased more and in the middle one, Shanyou 63, kept in a middle range. And the index of unsaturated fatty acid was higher in tolerant cultivars, while the recycle of ascorbate and glutathione in leaves, particularly the turnover of glutathione in leaves in the middle tolerant cultivar Shanyou63 activated highly as compared with the sensitive one, Xiangxian. It is indicated that the cold tolerance rice cultivars keep higher index of unsaturated fatty acid and capacity for turnover of glutathione, which exhibited stable photosynthetic rate and primary PS II photochemical efficiency (Fv/Fm) in leaves after chilling treatment.

**Key words** [Rice](#) [Chilling tolerance](#) [Physiological basis](#)

DOI:

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