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前沿资讯

1．专家团队发现了一个新的水稻半矮秆突变体osubr7

简介：近日，华南农业大学生命科学学院、国家重点实验室刘耀光院士团队在植物学新刊Plant Communications（影响因子8.625，生物1区）发表了题为“Rice OsUBR7 modulates plant height by regulating histone H2B monoubiquitination and cell proliferation ”的研究论文（论文链接：https://doi.org/10.1016/j.xplc.2022.100412）。水稻（Oryza sativa L.）是世界上最重要的粮食作物之一，同时也是单子叶植物基因组和遗传学研究的模式生物。株高作为农作物抗倒伏和高产育种的重要农艺性状，也是影响水稻产量的重要影响因素之一。因此，深入研究水稻半矮秆基因的表达调控及其作用机制，可以为完善水稻株高发育的分子机理和育种改良提供理论依据。在本研究中发现了一个新的水稻半矮秆突变体osubr7以及相关基因OsUBR7，该基因编码一个单泛素化修饰组蛋白H2B（H2Bub1）的E3泛素连接酶。H2Bub1是染色质中组蛋白的一种常见且重要的表观遗传修饰，与真核生物的基因转录活性的调节密切相关。然而，H2Bub1在植物株高发育中的调节作用仍然很少被研究。本研究通过一系列生化实验证明了OsUBR7作为一种新的E3连接酶催化水稻H2B单泛素化，是许多与细胞增殖和器官发育相关的基因位点的表观遗传调节因子。在野生型水稻中，OsUBR7特异性结合某些染色质区域的H2B并在K148处单泛素化修饰，此过程由OsUBC18充当OsUBR7的特异性E2泛素结合酶。通过改变这些基因位点的染色质状态，维持正常转录和细胞周期进程以确保正常发育。然而，在osubr7突变体植株中，OsUBR7的功能丧失导致靶基因位点的H2Bub1水平降低，从而降低靶基因的表达水平。受到抑制的细胞周期进程会导致节间变短，从而导致osubr7突变体的株高降低。OsUBR7所介导的这一新的植物H2Bub1修饰机制，不仅扩展了UBR7家族在真核生物中的已知功能也可以作为未开发的表观遗传资源，用来改善作物的株型和抗倒伏性状。

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http://agri.ckcest.cn/file1/M00/10/0A/CsgkOGLZEOWAdh5LAANk5k3aKF4190.pdf

2．专家揭示水稻花粉育性的新调控因子

简介：作物花粉不育种质材料是杂种优势利用的基础。花粉有结构复杂的细胞壁（主要由孢粉素组成，可分为花粉外壁与内壁），花粉壁赋予了花粉抗生物和非生物逆境的能力，并参与了花粉与柱头细胞的互作与信息交流，是决定花粉活性和功能的重要因素。目前，已发现多个影响孢粉素前体生物合成的基因，但已知的调控因子有限。中国科学院植物研究所王台研究组等发现，水稻花粉表达的甲基化CpG位点结合蛋白家族成员PEM1是调控花粉外壁形成的重要调控因子。该基因功能缺失导致花粉外壁无定型加厚，乌氏体异常，进而致使花粉降解。进一步研究发现，该基因功能缺失引起转录抑制、信号转导和细胞壁代谢相关基因表达水平的显著增加，以及孢粉素前体角质和蜡质组分含量的显著增加，这表明PEM1通过负调控一组基因的表达来调节花粉外壁的发育，可能是花粉发育的主调控因子。序列分析显示PEM1同源序列在单子叶植物中是保守的，暗示PEM1同源基因在其他单子叶植物花粉发育过程中有类似的功能。该研究揭示了一个新的水稻花粉育性的主调控因子，为解析花粉外壁发育的调控网络提供了新的切入点，也为

植物雄性育性的遗传操作提供了新的基因元件。
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学术文献

1. In Memory of the Father of Hybrid Rice(纪念杂交水稻之父)

简介：Prof. Yuan devoted his whole life to the research of hybrid rice. On the first anniversary of Prof. Yuan Yuan's death, our research team wrote a paper to commemorate him. In this paper, we recalled his life, his research progress and achievements of hybrid rice. He led and guided his research team to overcome difficulties in hybrid rice research. Hybrid rice has made important contributions to China and world's food security. He is a great researcher worthy of our memory forever in the world.
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2. The Next Generation of Rice_ Inter-Subspecific Indica-Japonica Hybrid Rice(下一代水稻-亚种间籼粳杂交稻)

简介：Rice (Oryza sativa) is an important food crop and has two subspecies, indica and japonica. Since the last century, four generations of rice varieties have been applied to rice production. Semi-dwarf rice, intra-subspecific hybrid rice, and inter-subspecific introgression rice were developed successively by genetic modification based on the first generation of tall rice. Each generation of rice has greater yield potential than the previous generation. Due to the stronger heterosis of indica-japonica hybrids, utilization of the inter-subspecific heterosis has long been of interest. However, indica-japonica hybrid sterility hinders the utilization of heterosis. In the past decades, indica-japonica hybrid sterility has been well understood. It is found that indica-japonica hybrid sterility is mainly controlled by six loci, S5, Sa, Sb, Sc, Sd, and Se. The indica-japonica hybrid sterility can be overcome by developing indica-compatible japonica lines (ICJLs) or widecompatible indica lines (WCILs) using genes at the loci. With the understanding of the genetic and molecular basis of indica-japonica hybrid sterility and the development of molecular breeding technology, the development of indica-japonica hybrid rice has become possible. Recently, great progress has been made in breeding indica-japonica hybrid rice. Therefore, the indica-japonica hybrid rice will be the next generation of rice. It is expected that the indica-japonica hybrid rice will be widely applied in rice production in the near future.
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3. Production of aromatic three-line hybrid rice using novel alleles of BADH2(利用BADH2新等位基因生产芳香型三系杂交水稻)

简介：Aroma is a key grain quality trait that directly influences the market price of rice globally. Loss of function of betaine aldehyde dehydrogenase 2 (OsBADH2) affects the biosynthesis of 2-acetyl-1- pyrroline (2-AP), which is responsible for aroma in fragrant rice. The current study was aimed at creating new alleles of BADH2 using CRISPR/Cas9 gene editing technology under the genetic background of the japonica Ningjing 1 (NJ1) and indica Huang Huazhan (HHZ) varieties. Sensory evaluation and analysis using headspace solid-phase microextraction gas chromatographymass spectrometry (HS-SPME-GC-MS) showed that the grains of the four homozygous T1 lines with new alleles of BADH2 (nj1-cr BADH2-1, nj1-cr BADH2-2, hhz-cr BADH2-1 and hhz-cr BADH2-2) produced moderate fragrance and had significantly increased 2-AP content compared with wild-types. Moreover, there were no significant differences in the amylose content and gelatinization temperature among the four lines with new alleles of BADH2 to the wild-types. Thereafter, we crossed the HHZ background new alleles of BADH2 with CMS line Taonong 1A (TN1A) to produce a three-line hybrid variety B-Tao-You-Xiangzhan (BTYXZ) with increased grain aroma. The 2-AP content in grains of the improved BTYXZ-1 and BTYXZ-2 reached at 26.16 and 18.74 μg/kg, and the gel consistency of BTYXZ-1 and BTYXZ-2 increased significantly by 9.1% and 6.5%, respectively, compared with the wild-type Tao-You-Xiangzhan (TYXZ). However, the γaminobutyric acid (GABA) content in the improved three-line hybrid rice BTYXZ-1 (5.6 mg/100 g) and BTYXZ-2 (10.7 mg/100 g) was significantly lower than that of the TYXZ. These results demonstrated that CRISPR/Cas9 gene editing technology could be successfully utilized in improving aroma in non-fragrant japonica and indica varieties. In addition, the newly developed BADH2 alleles provided important genetic resources for grain aroma improvement in three-line hybrid rice.

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