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小麦遗传育种专题

本期导读

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前沿资讯

1．Breeding from 1891 to 2010 did not increase the content of amylase/trypsin-inhibitors in wheat (Triticum aestivum)(不增加淀粉酶/胰蛋白酶抑制剂含量的小麦育种（1891-2010年））

简介：The prevalence of hypersensitivities towards wheat has increased in the last decades. Apart from celiac disease these include allergic and other inflammatory reactions summarized under the term non-celiac wheat sensitivity. One suspected trigger is the family of amylase/trypsin-inhibitors (ATIs), non-gluten proteins that are prominent wheat allergens and that activate the toll-like receptor 4 on intestinal immune cells to promote intestinal and extra-intestinal inflammation. We therefore quantified 13 ATIs in 60 German hexaploid winter wheat cultivars originating from 1891 to 2010 and harvested in three years by targeted liquid chromatography-tandem mass spectrometry combined with stable isotope dilution assay using specific marker peptides as internal standards. The total ATI content and that of the two major ATIs 0.19 and CM3 did not change from old cultivars (first registered from 1891 to 1950) to modern cultivars (19512010). There were also no significant changes in ATI distribution.

来源：Nature

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file1/M00/03/5E/CsgkOYlFZLmAEwwwAB3WbrdZens036.pdf

学术文献

1．Transfer of the high-temperature adult-plant stripe rust resistance gene Yr62 in four Chinese wheat cultivars(高温成株抗条锈病基因Yr62在4个中国小麦品种中的转移)

简介：Wheat stripe rust is one of the diseases that seriously affect wheat production worldwide. Breeding resistant cultivars is an effective way to control this disease. The wheat stripe rust resistance gene Yr62 has high-temperature adult-plant resistance (HTAP). In this study, PI 660,060, a single Yr62 gene line, was crossed with four Chinese wheat cultivars, LunXuan987 (LX987), Bainongaikang58 (AK58), ZhengMai9023 (ZM9023), and HanMai6172 (H6172). F_1 seeds of four cross combinations were planted and self-crossed to develop the advance generations in the field. The seeds of each cross were mixed harvested and about 2400 to 3000 seeds were sown in each generation for F_1 to F_4 to maintain the maximum possible genotypes. Forty-five lines were selected and evaluated for resistance to stripe rust and agronomic traits, including plant height, number of grains per spike, and tiller number, in F5 and F6. Then, 33 lines with good agronomic traits and high disease resistance were developed to F9 generation. SSR markers Xgwm251 and Xgwm192 flank linked with the Yr62 were used to detect the presence of Yr62 in these 33 F9 lines. Of these, 22 lines were confirmed with the resistance gene Yr62. Finally, nine lines with good agronomic traits and disease resistance were successfully selected. The selected wheat lines in this study provide material support for the future breeding of wheat for stripe rust resistance.

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2．Breeding Wheat for Powdery Mildew Resistance: Genetic Resources and Methodologies—A Review（小麦抗白粉病育种：遗传资源与方法综述）

简介：Powdery mildew (PM) of wheat caused by Blumeria graminis f. sp. tritici is among the most important wheat diseases, causing significant yield and quality losses in many countries worldwide. Considerable progress has been made in resistance breeding to mitigate powdery mildew. Genetic host resistance employs either race-specific (qualitative) resistance, race-non-specific (quantitative), or a combination of both. Over recent decades, efforts to identify host resistance traits to powdery mildew have led to the discovery of over 240 genes and quantitative trait loci (QTLs) across all 21 wheat chromosomes. Sources of PM resistance in wheat include landraces, synthetic, cultivated, and wild species. The resistance identified in various genetic resources is transferred to the elite genetic background of a well-adapted cultivar with minimum linkage drag using advanced breeding and selection approaches. In this effort, wheat landraces have emerged as an important source of allelic and genetic diversity, which is highly valuable for developing new PM-resistant cultivars. However, most landraces have not been characterized for PM resistance, limiting their use in breeding programs. PM resistance is a polygenic trait; therefore, the degree of such resistance is mostly influenced by environmental conditions. Another challenge in breeding for PM resistance has been the lack of consistent disease pressure in multi-environment trials, which compromises phenotypic selection efficiency. It is therefore imperative to complement conventional breeding technologies with molecular breeding to improve selection efficiency. High-throughput genotyping techniques, based on chip array or sequencing, have increased the capacity to identify the genetic basis of PM resistance. However, developing PM-resistant cultivars is still challenging, and there is a need to harness the potential of new approaches to accelerate breeding progress. The main objective of this review is to describe the status of breeding for powdery mildew resistance, as well as the latest discoveries that offer novel ways to achieve durable PM resistance. Major topics discussed in the review include the genetic basis of PM resistance in wheat, available genetic resources for race-specific and adult-plant resistance to PM, important gene banks, and conventional and complimentary molecular breeding approaches, with an emphasis on marker-assisted selection (MAS).

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3 . Host and Pathogen Factors Determining Yellow Rust Reaction in Wheat- An Overview（决定小麦黄锈病反应的寄主和病原菌因素综述）

简介：Among cereals, wheat is one of the most important crop globally, being a major component of food security. Among rust diseases of wheat, yellow rust is an important which result in considerable losses in normal and colossal losses in epidemic conditions. The disease-causing organism Puccinia striiformis is an obligate pathogen with diverse pathotypes which have the ability to invade resistance of the wheat varieties due to prevalence of new pathotypes. It is therefore, important to understand the virulence patterns of pathotypes and host resistant genes to create a mismatch for sustainable production. This review paper examines the losses due to yellow rust, variability in pathogen for virulence, migration of pathogen, meteorological pre-disposing factors, types and number of resistant genes governing yellow rust resistance at various plant growth stages, identification of resistant genes through conventional and molecular markers, conventional and biotechnological methods for developing yellow rust resistant wheat varieties and futuristic outlook to tackle yellow rust epidemic under climate change regime through breeding and management strategies.

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科技图书

1 . Biofortification of Wheat Using Current Resources and Future Challenges（小麦生物强化利用现状及未来挑战）

简介：Wheat is the second most significant staple food grain crop after rice; however, its grains mostly contain suboptimal levels of provitamins, proteins, and essential micronutrients, including zinc, iron, selenium, and iodine. However, during processing, wheat flour is enriched or fortified with several required nutrients. The most reasonable, long-lasting, and viable solution for this problem is biofortification that can be performed through either agronomic approaches, breeding efforts, or transgenic techniques. Agronomic fertilization techniques for wheat biofortification include basal application, foliar spray, and seed priming with the appropriate nutrient sources. Recently, various potent bacterial strains have been used, and these techniques can be used in combination with agronomic and genetic techniques to significantly enhance the density of the nutrients that require to be supplemented in wheat grains. Compared to agronomic approaches, breeding techniques are more sustainable and include conventional and marker-assisted breeding. Transgenic approaches for micronutrient biofortification of wheat include modulation of the gene expression of transporters to improve the absorption rate and assimilation capability of the wheat plant while lowering antinutrient content. In this chapter, along with the possible techniques of biofortification, we discuss the mode of uptake and deposition of the desired nutrients in the grain at molecular and physiological levels. We discuss the possible wheat genomic obstacles that hinder wheat biofortification as well as the economic and social challenges for the release of biofortified wheat.

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