APPLYING SIMPLE SEQUENCE REPEAT (SSR) MARKER IN SCREENING *FUSARIUM* HEAD BLIGHT RESISTANT PARENTS

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ABSTRACT

The QTL on wheat chromosome arm 3BS from *Fusarium* head blight (FHB) resistant cultivar Sumai 3 is a major contributor to FHB resistance. Two SSR markers (Xgwm533 and Xgwm493) have been found closely linked to the resistant QTL. This project aimed at screening FHB resistant parents used in the South Dakota spring wheat improvement program for these SSR molecular markers. This is the first step toward implementation of marker assisted selection (MAS). Fifty lines in the Fall Crossing Block (FCB00), 24 lines from the Preliminary Yield Experiment (PPY) in the year of 2000, and three FHB resistant lines with unknown pedigrees in spring wheat project, were analyzed with the SSR markers Xgwm533 and Xgwm493. Eight lines were found to possess Xgwm533, and 36 lines possess Xgwm493. This information will be applied in MAS for FHB resistance.

Keywords

Fusarium head blight, SSR, Molecular marker assisted selection, Spring wheat

INTRODUCTION

The resistance to *Fusarium* Head Blight (FHB, also called scab) is inherited in a quantitative manner (Waldron et al., 1999). The development of wheat cultivars resistant to FHB is hindered by the lack of sources of high levels of resistance and by low heritability of the available resistance resources (Anderson et al., 2000). Selection for molecular markers linked to FHB resistant QTLs has the advantage to enhance the efficiency of genetic improvement compared to selection for resistance in field or greenhouse because of the stability across years and environments. Efforts have been made to identify DNA markers linked to FHB resistance in wheat (Bai et al., 1999; Anderson et al., 2000). Simple sequence repeats (SSRs) are abundant, codominant, highly polymorphic

and widely dispersed in diverse genomes as well as easy to assay by PCR. All of these, plus the easy dissemination among laboratories make SSRs an applicable marker in FHB resistant breeding.

Up to date, spring wheat cultivar Sumai 3 has been found to have the highest resistance to FHB and is widely used in breeding for FHB resistance. The most significant QTL for FHB resistance was located on the short arm of 3B chromosome. (Anderson et al., 1998). Researchers have found several SSR markers linked to the QTL in Sumai 3 or Sumai 3 derived populations. These markers are Xgwm533, Xgwm 493, and Xgwm389 (Anderson et al., Chen et al., Zhou et al., 2000) among which Xgwm 533 is the most closely linked marker and explains 17-24.6% variation of FHB resistance in the tested populations (Anderson et al., 2000). Xgwm389 and Xgwm493 are flanking the major QTL in 3BS. The linkage distance between the two markers is 10.1 cM. The probability of missing the major QTL by selecting both markers is 0.25% if the QTL is located in middle of the two markers (Zhou et al., 2000). These three markers are suitable to be applied in marker assisted breeding (MAS).

This project aimed at screening FHB resistant parents used in the South Dakota spring wheat improvement program for these SSR molecular markers. This is the first step toward implementation of marker assisted selection (MAS).

MATERIAL AND METHOD

Plant materials

Fifty lines in the Fall Crossing Block (FCB00), 24 lines from the Preliminary Yield Experiment (PPY) in the year of 2000, and three FHB resistant lines with unknown pedigrees in Spring Wheat Project were used in this research.

DNA isolation

DNA was extracted from 0.1g young leaf for each line using plant DNA zol solution and followed the manufacture's procedure (Life technologies Inc.).

SSR analysis

SSR primers were synthesized by Life technologies Inc. according to sequence information published by Röder et al. (1998). PCR amplification followed the method of Röder et al. (1995). Silver staining was used to detect the PCR products after separation on a sequence gel following a protocol described by Xing et al (2000).

RESULT AND DISCUSSION

The summaries of the assay results are shown in Table 1. The results showed that out of all 78 assigned lines, eight lines had the SSR marker Xgwm533, and 36 lines had Xgwm493 (10%, 46% receptively).

Table 1. Summaries of SSR assay

Lines		Xgwm533 only		Xgwm493 only		Xgm533 and Xgwm493	
Pedigree	*Number*	+	-	+	-	+	-
With Sumai 3	23	3	16	7	12	4	8
Without Sumai 3	51	0	51	23	28	0	26
Unknown	4	0	3	1	2	1	2
Total	*78*	*3*	*70*	*31*	*42*	*5*	*36*

+: With markers
-: Without markers

Our results also showed that all lines with SSR marker Xgwm533 had Sumai 3 as resistance resources except N99-0107, which was developed by AgriPro Seed company, its pedigree information is unknown to our project. All the lines with this marker had at least moderate resistance to FHB.

Although Xgwm 533 was considered as the nearest marker linked to FHB resistance QTL in chromosome 3BS (Anderson et al, 2000), it existed only in a few lines and expressed differently among lines with same pedigree. About 70% of FHB-resistant lines did not have this marker even though they were derived from Sumai 3 indirectly. It seemed that the linkage between this marker and the 3BS FHB resistance QTL was easily broken through crosses.

A large proportion of the lines was assayed to have Xgwm493, including some susceptible lines without Sumai 3 in their pedigree. Therefore, this marker did not show much polymorphism between resistant and susceptible lines and thus must be used with caution.

One of the most commonly used FHB resistant lines in our breeding project SD 3411 were found to have marker Xgwm493. The information would be applied in MAS soon.

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