

# MOLECULAR CYTOGENETIC IDENTIFICATION, PHYSICAL MAPPING AND DROUGHT TOLERANCE OF WHEAT-BARLEY INTROGRESSION LINES



Márta Molnár - Láng\*, Éva Szakács, István Molnár, András Cseh, Adél Sepsi, Klaudia Kruppa, Sándor Dulai, Borbála Hoffmann and Ruilian Jing\*\*

\* ARI HAS, Martonvásár, HUN \*\* CAAS, Beijing, CHN

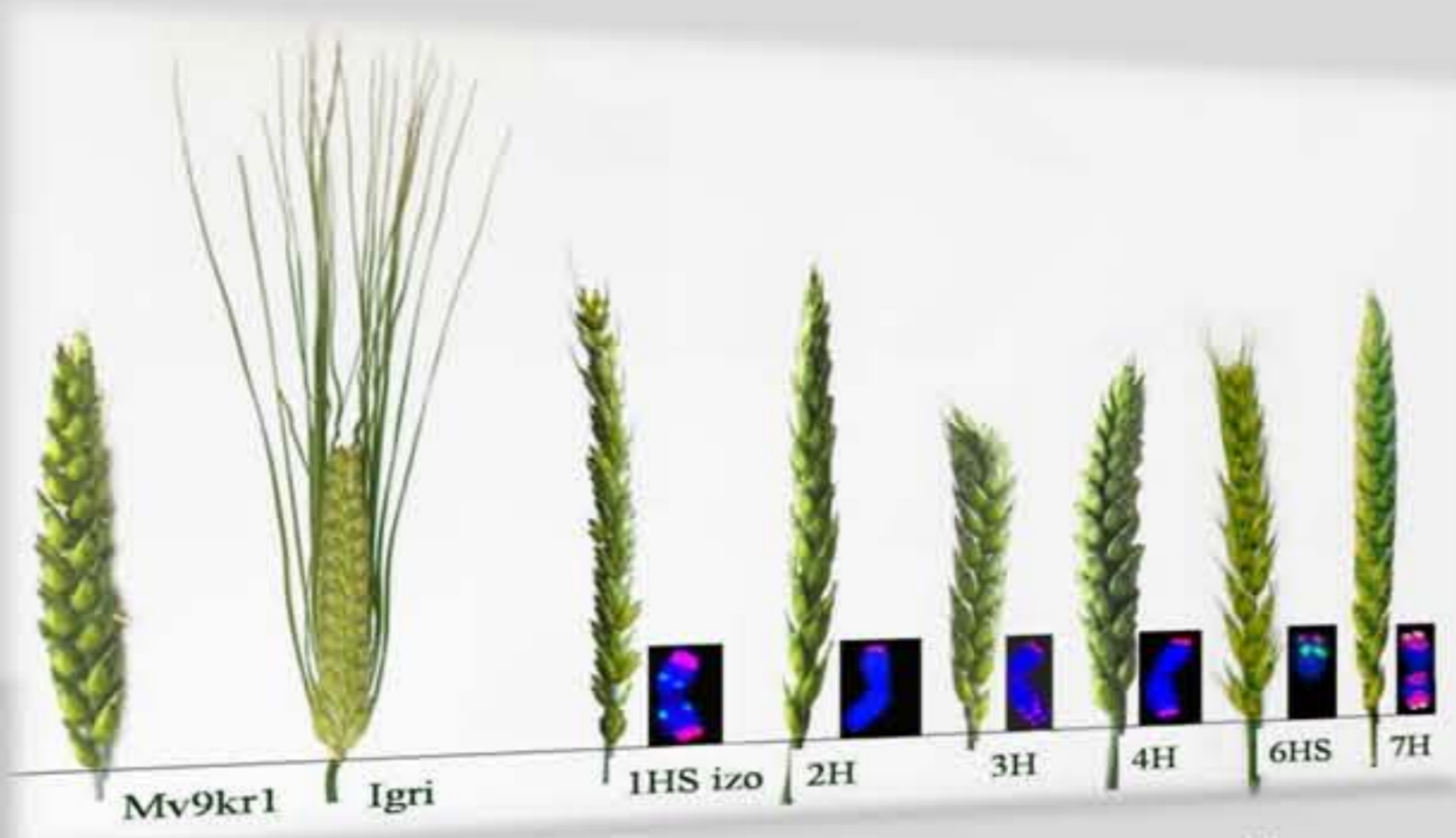


Fig. 1 Spikes of wheat/barley addition lines (Mv9kr1/Igri) and the FISH pattern of the barley chromosomes using HvT01 (red) and pTa71 (green) probes

## PLANT MATERIALS

**Wheat genotypes:**  
Mv9kr1 (Hungarian)  
Asakaze komugi (Japanese)  
Chinese Spring  
Wheat-barley addition, substitution and translocation lines

**Barley cultivars:**  
Betzes (German)  
Igri (German)  
Manas (Ukrainian)

## Drought tolerance test in the field:

Beijing, (CHN): 15 genotypes were sown under a rain shelter and under irrigated conditions (Fig. 4)

Martonvásár, (HUN): 17 genotypes were sown under a rain shelter and under irrigated conditions (Fig. 5)

Keszthely, (HUN): 12 genotypes, the half length of the rows was covered with a plastic folia (Fig. 6)



Fig. 4 Chinese Spring and 4H(4D) wheat/barley substitution line plants grown under drought stress and control conditions in China



Beijing



Martonvásár



Keszthely

Fig. 5,6,7 Drought tolerance tests under rain shelters in Beijing, Martonvásár and Keszthely

## INTRODUCTION

Barley is a potential gene source for wheat improvement, because of its good drought tolerance, earliness and nutritional parameters. Wheat-barley introgression lines were developed in Martonvásár, and were used to determine how the added barley chromosomes (segments) influence various agronomic traits in wheat.

## METHODS

### 1. In situ hybridization:

Fluorescent *in situ* hybridization (FISH) with repetitive DNA probes (HvT01, GAA, Afa-family, pTa71 and pSc119.2)

Genomic *in situ* hybridization (GISH): total barley genomic DNA probe

Labelling: biotin-avidin FITC and digoxigenin- antidig-rhodamine

### 2. Wheat and barley SSR markers

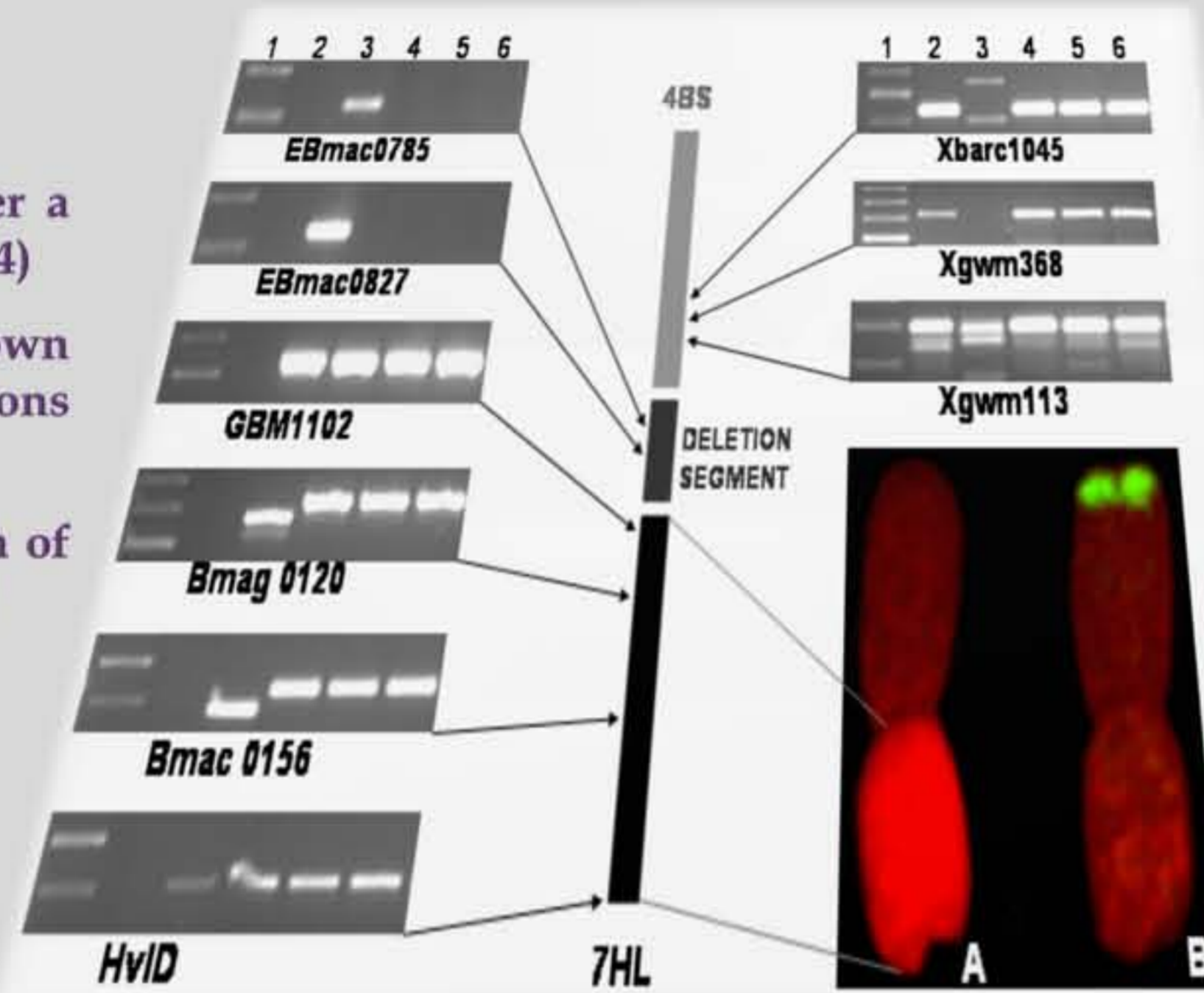


Fig. 3 Physical map of SSR markers within the 4BS.7HL translocation, including the centromeric deletion of 7HL (A). The electrophoretic patterns of the 7HL specific markers are indicated on the left of the schematic chromosome while the electrophoretic patterns of the 4BS-specific markers are indicated on the right (1: size marker 50 bp; 2: Chinese Spring; 3: Manas; 4,5,6: DNAs from the translocation lines)

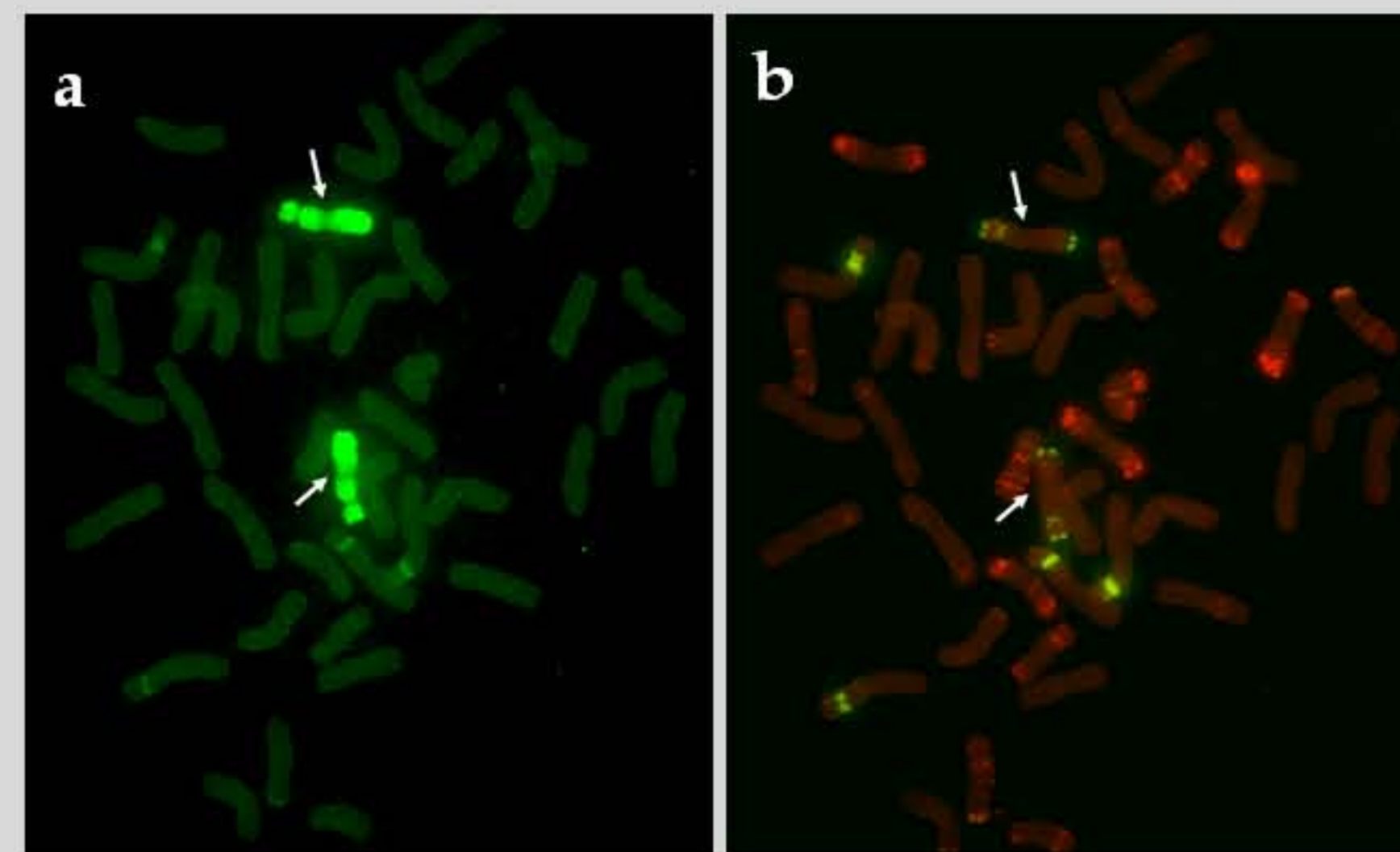


Fig. 2 Detection of the 6H chromosome in the wheat/barley addition line using GISH (a) and FISH (b) with the DNA probes HvT01, Afa-family and pTa71 (arrows)

## RESULTS

New wheat/barley disomic addition line set was developed from the Asakaze komugi × Manas and from the Mv9kr1 × Igri hybrid combination (Fig. 1). The presence of the barley chromosomes in wheat background was demonstrated using GISH (Fig. 2a). Identification of the individual chromosomes was carried out by FISH and SSR markers (Fig. 2b). New wheat-barley translocation lines were detected with GISH.

Physical mapping of wheat and barley SSR markers was carried out on wheat 7D and barley 7H chromosomes with the help of wheat/barley translocation lines (Fig. 3). The drought tolerance of the wheat-barley introgression lines was studied under rain shelter in three different locations (Fig. 5, 6, 7) in two consecutive years. Data were obtained for heading date, plant height, root/shoot ratio and components of grain yield (Fig. 4).

## CONCLUSIONS

The most favourable results for root/shoot ratio were measured in case of 7D-5HS and 4H(4D) substitution in Keszthely. The present observations confirmed the earlier data in PEG induced osmotic stress (15%) where the water use efficiency (WUE) of the 4H(4D) substitution line was much higher than the wheat parent.

The 3HS.3BL wheat-barley centric fusion and the 3H and the 4H Mv9kr1/Igri disomic addition lines had the most favourable drought resistance index among the wheat/barley introgression lines studied in China. Conclusions about the drought tolerance of the different lines can be made after several years of observations.

Related GCP project: SP3 G4007.23 Field evaluation of wheat-barley introgression lines under different water regimes