QTL associated with adaptation to Mediterranean Dryland conditions in the barley cross Arta x Keel

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Introduction and Objectives
The study aims at identifying the genetic basis for agronomic performance in dry Mediterranean environments. We use a QTL approach to map different agronomic traits recorded in the field and physiological and protein changes in the RILs grown under drought in the greenhouse.

QTL Analysis for Agronomic Traits under Drought in RILs (Arta x Keel)

Main effects across environments
Arta increases trait value
Keel increases trait value
Marker = environment interaction

Results
The different environments analyzed showed a large variation in temperature and rainfall distribution which resulted in significant genotype by environment interactions. Developmental and morphological traits affected grain yield differently in different environments which was reflected in a number of QTL by environment interactions.

QTL main effects across all environments were only detected for plant height, peduncle length, kernel weight and growth vigor. Grain yield under drought was mainly affected by flowering time. Epistatic interactions between different parental alleles at Vrn-H1, Vrn-H2 and a QTL on 7HL caused late flowering and a concomitant decline in yield.

Epistatic interactions for flowering

Analysis of epistatic interactions revealed interactions between QTLs and markers not significant in the single marker analysis. The QTL at Vrn-H2 showed the largest number of epistatic interactions. Interactions between different parental alleles at Vrn-H1, Vrn-H2 and a QTL on 7HL explained 50% of the genetic variance, caused late flowering and a concomitant decline in yield.

Drought reduced kernel weight in Arta and Keel, while Keel showed higher kernel weight under control and drought conditions. Keel was characterised by a higher water use efficiency than Arta.