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Identification of quantitative trait loci for mineral elements in grains and grass powder of barley

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ABSTRACT. Mineral elements in barley (*Hordeum vulgare*) play an important physiological role in global human health. In this study, quantitative trait loci (QTLs) for concentration of nine mineral elements in barley grain and grass powder were detected in a population of 193 recombinant inbred lines of the barley cross Ziguangmangluoerling x Schooner and the parents. We observed large genetic variation contributing to element concentrations in both grains and grass powder. The mean K, Ca, and Fe concentrations in grass powder were 6.67, 12.00, and 4.58 times that of regenerating barley grains. In grains, 17

QTLs that accounted for 6.36-64.08% of the phenotypic variation in Zn, Mg, Ca, K, Na, Mn, Fe, and P concentrations were identified. In grass powder, seven QTLs were identified; these accounted for 6.03-21.86% of the variation in Ca, Zn, Mg, K, Fe, and Cu concentrations. These QTLs affecting elements in grain and grass powder are so far unreported in barley. To our knowledge, QTLs with pleiotropic effects for three elements were also identified for the first time in barley. The *qK1*/*qMg1*/*qCa1* region between markers Bmag0211 and GBMS0014 on chromosome 1H was shown to have large additive effects for Mg, Ca, and K concentrations in grains. These additive effects indicated that the high element (Mg, Ca, Zn, Mn, and K) alleles were contributed by Ziguangmangluoerling. These results will further our understanding of the genetic basis of mineral elements and help us develop markers linked with mineral elements for marker-assisted selection breeding in barley.

Key words: Quantitative trait locus; Mineral element; Grain; Grass powder; Recombinant inbred lines; Barley