

## **Description of Additional Supplementary Files:**

**Supplementary Data 1:** Differentially expressed proteins in pgIX mutant in comparison with its wild type.

**Supplementary Data 2:** Altered expression of carbohydrate metabolism-related genes in unique interaction (UI) regions, chromosomal interaction domain (CID) regions, and insulation areas (IAs) in pgIX mutant.

**Supplementary Data 3:** Distribution of transcription factor binding site (TFBS) motifs across 28 *Lactocaseibacillus paracasei* isolates.

**Supplementary Data 4:** Information of downstream genes of the conserved motifs.

**Supplementary Data 5:** Information of primers used in real timequantitative polymerase chain reactions (RT-qPCRs).