

Competing interests

The authors declare that they have no competing interests.

Legends for Appendixes

Appendix A. Reported carbohydrate esterases in three *Phytophthora* and two other oomycete species.

Appendix B. Carbohydrate esterases predicted by CAT analysis with an E-value cutoff of $1e-50$. Proteins that were also identified as proteases by MEROPS analysis are presented in brackets.

Appendix C. Carbohydrate esterases predicted by dbCAN analysis. Proteins that were also identified as proteases by MEROPS analysis are presented in brackets.

Appendix D. Genes annotated by CAT and dbCAN analyses predicted to be proteases by MEROPS analysis.

Appendix E. A total of 445 CEs identified by PLdgc (pipeline to discovering CE genes).

Appendix F. A total of 169 genes annotated by proteases from MEROPS database were removed from the PLdgc analysis.

Appendix G. List of 299 secreted CE genes. Signal peptides were predicted by four methods

(including SignalP, TargetP, Phobius and Predisi) and transmembrane sequences were identified by three methods (SignalP, Phobius and TMHMM).

Appendix H. Phylogenetic analysis of GDSSL-like lipase/acylhydrolase domain sequences from 13 CE genes. These 13 genes were annotated as CE3 by dbCAN method. The annotated CE2, CE3, CE12 genes in CAZy database and other annotated CE12 genes in this study were used to build the neighbour-joining tree using TreeBeST with the p-distance model (bootstrap 1000). The tree showed that these 13 genes could not be clustered with other CE3 genes.

Appendix I. Proteins similar to CEs of *P. infestans* selected for comparative analysis in this study, including 230 proteins forming eight one-core subnetworks. Among these associations, PITG_06891 (an esterase) and PITG_14270 (a pectinacetylerase) were the strongest. The name for each gene was shown without the prefix of 'PITG_'.

Appendix J. Proteins related to CEs of *P. infestans* are listed, including 230 proteins which form eight one-core subnetworks, which were obtained from study by Seidl et al. (2013). For example, one pair of associated proteins was PITG_00029-PITG_06891.

Appendix K. The association between pectinacetylerase and proteins in other *Phytophthora* species with corresponding annotations.