Supplementary Table 1. Information of insect chitinase proteins for phylogenetic tree construction

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| --- | --- | --- | --- |
| Species | Protein | Accession number | Phylogenetic group |
| *Anopheles gambiae* | *AgCht2* | XP\_315650 | Diptera |
| *AgCht4* | XP\_315351 | Diptera |
| *AgCht5-1* | HQ\_456129 | Diptera |
| *AgCht5-2* | HQ\_456130 | Diptera |
| *AgCht5-3* | HQ\_456131 | Diptera |
| *AgCht5-4* | HQ\_456132 | Diptera |
| *AgCht5-5* | HQ\_456133 | Diptera |
| *AgCht7* | XP\_308858 | Diptera |
| *AgCht8* | XP\_316448 | Diptera |
| *AgCht10* | XP\_001238192 | Diptera |
| *AgCht11* | XP\_310662 | Diptera |
| *AgIDGF2* | XP\_001237925 | Diptera |
| *AgIDGF4* | XP\_317398 | Diptera |
| *Drosophila melanogaster* | *DmCht2* | NP\_477298 | Diptera |
| *DmCht4* | NP\_524962 | Diptera |
| *DmCht5* | NP\_650314 | Diptera |
| *DmCht7* | NP\_647768 | Diptera |
| *DmCht8* | NP\_611542 | Diptera |
| *DmCht9* | NP\_611543 | Diptera |
| *DmCht10* | EAA46011 | Diptera |
| *DmCht11* | NP\_572361 | Diptera |
| *DmIDGF1* | NP\_477258 | Diptera |
| *DmIDGF2* | NP\_477257 | Diptera |
| *DmIDGF3* | NP\_723967 | Diptera |
| *DmIDGF4* | NP\_727374 | Diptera |
| *DmIDGF5* | NP\_611321 | Diptera |
| *DmIDGF6* | NP\_477081 | Diptera |
| *Tribolium castaneum* | *TcCht4* | NP\_001073567 | Coleoptera |
| *TcCht5* | NP\_001034524 | Coleoptera |
| *TcCht6* | XP\_967813 | Coleoptera |
| *TcCht7* | NP\_001036035 | Coleoptera |
| *TcCht8* | NP\_001038094 | Coleoptera |
| *TcCht9* | NP\_001038096 | Coleoptera |
| *TcCht10* | NP\_001036067 | Coleoptera |
| *TcIDGF2* | NP\_001038092 | Coleoptera |
| *TcIDGF4* | NP\_001038091 | Coleoptera |
| *TcENGase* | XP\_969648.1 | Coleoptera |
| *Bombyx mori* | *BmCht1-1* | XP\_004931749 | Lepidoptera |
| *BmCht2* | XP\_004933352 | Lepidoptera |
| *BmCht5* | AAB47538 | Lepidoptera |
| *BmIDGF* | NP\_001036847 | Lepidoptera |
| *Phenacoccus solenopsis* | *PsCht3-3* | MH686272 | Hemiptera |
| *PsCht5* | MH686266 | Hemiptera |
| *PsCht10* | MH686270 | Hemiptera |
| *PsIDGF* | MH686273 | Hemiptera |
| *Aphis gossypii* | *AgoCht3-2* | KAF0755855 | Hemiptera |
| *Apis mellifera* | *AmCht10* | XP\_026299805 | Hymenoptera |
| *AmENGase* | XP\_001121069 | Hymenoptera |
| *Bactrocera dorsalis* | *BdCht1* | MF926351 | Diptera |
| *BdCht2* | KF289944 | Diptera |
| *BdCht5* | KY681041 | Diptera |
| *BdCht7* | KY681042 | Diptera |
| *BdCht8* | KY426795 | Diptera |
| *BdCht10* | MK518061 | Diptera |
| *BdCht11* | KY426794 | Diptera |
| *BdIDGF1* | KY681043 | Diptera |
| *BdIDGF2* | KY681044 | Diptera |
| *BdIDGF3* | KY681045 | Diptera |
| *BdIDGF4* | KY681046 | Diptera |
| *BdIDGF6* | KY426796 | Diptera |
| *Nilaparvata lugens* | *NlCht5* | KM217113 | Hemiptera |
| *NlCht6* | KM217114 | Hemiptera |
| *NlCht7* | KM217115 | Hemiptera |
| *NlCht10* | KM217118 | Hemiptera |
| *NIIDGF* | KM217119 | Hemiptera |
| *Acyrthosiphon pisum* | *ApCht3* | XM\_001952683 | Hemiptera |
| *ApCht7* | XM\_001950345 | Hemiptera |
| *ApCht10* | XM\_001943003 | Hemiptera |
| *ApIDGF* | [NM\_001168671](https://www.ncbi.nlm.nih.gov/nuccore/NM_001168671) | Hemiptera |
| *ApENGase* | XM\_001949910 | Hemiptera |

Supplementary Table 2. Primers for qPCR the genes of chitinase in *Acyrthosiphon pisum*

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| --- | --- | --- |
| Genes | Primers | Nucleotide sequence (5′-3′) |
| *ApIDGF* | *ApIDGF*-F  *ApIDGF*-R | GGGTATCTCTACGTACGGCC  AAGGGTGAGAGATGTGGTGG |
| *ApCht3* | *ApCht3*-F  *ApCht3*-R | CGGCAAGGACGGTTTTGTAA  GAAAATACCATGGCGCCTCC |
| *ApCht7* | *ApCht7*-F  *ApCht7*-R | TACCTGAAGACATCGACCCG  AACTTTTGTGTGCCGAACGA |
| *ApCht10* | *ApCht10*-F  *ApCht10*-R | ACTGGTCCAAGATCCACTGG  GATACGTTTCGCAGCCACAT |
| *ApENGase* | *ApENGase*-F  *ApENGase*-R | ATGTTGACGGTGAAGCAGTT  TCCCTGAATGCCAAACTCCA |
| *EF1α* | *EF1α*-F  *EF1α*-R | CTGTGCTTATTGTCGCTGCT  TCGCTGTATGGTGGTTCAGT |
| *RPS20* | *RPS20*-F  *RPS20*-R | AAGTGTGTGCTCCGAGATGA  CAGCAATGACACCGGGTTC |

Supplementary Table 3. Lengths of each exon and intron of Chitinase gene in *Acyrthosiphon pisum*

|  |  |  |
| --- | --- | --- |
| 基因  Gene | 类别  Structure | 从5’到3’长度  From 5’to 3’Length (5’-3’) |
| *ApIDGF* | Exon | 553, 400, 171, 133, 269, 345. |
| Intron | 3381, 1134, 223, 644,1701. |
| *ApCht3* | Exon | 548, 215, 224, 136, 271, 166, 103, 115. |
| Intron | 61, 65, 695, 449, 180, 59, 489. |
| *ApCht7* | Exon | 291, 90, 232, 237, 179, 123, 309, 235, 190, 217, 295, 147, 185, 122, 201, 908. |
| Intron | 16014, 8517, 1564, 922, 85, 75, 365, 61, 67, 85, 62, 67, 59, 89, 569. |
| *ApCht10* | Exon | 695, 282, 193, 182, 142, 135, 211, 133, 318, 135, 125, 185,142, 135, 211, 179, 363, 163, 204, 190, 452, 222, 112, 189, 227, 141, 129, 182, 53, 216, 305, 277, 188, 164, 91, 162, 125. |
| Intron | 57, 642, 91, 365, 91, 137, 95, 62, 883, 770, 65, 76, 63, 84, 64, 63, 61, 85, 80, 65, 568, 90, 377, 68, 63, 57, 66, 64, 71, 57, 72, 59, 72, 67, 324, 3749. |
| *ApENGase* | Exon | 1927, 224. |
| Intron | 442. |

Supplementary Figure 1. Conserved regions in the glycoside hydrolase family 18 (GH18) domain of 5 *A. pisum.* Amino acid sequences of the catalytic domains of GH18 family enzymes were aligned using CLUSTALX software. Two and four catalytic domains of *ApCht7* and *ApCht10* were named as *ApCht7-1/2* and *ApCht10-1/2/3/4*, respectively. Boxed regions are the four conserved motifs represented by the sequences KxxxxxGGW (Mofit Ⅰ), FDGxDLDWEYP (Mofit Ⅱ), MxYDxxG (Mofit Ⅲ) and GxxxWxxDxDD (Mofit Ⅳ).

