

## **Description of Additional Supplementary Files**

File Name: Supplementary Data 1

Description: Statistics of repeat compositions of the perilla genomes.

File Name: Supplementary Data 2

Description: List of species used in phylogenetic tree and gene family analysis.

File Name: Supplementary Data 3

Description: Cross-validation of 19 inversions by Illumina draft assemblies.

File Name: Supplementary Data 4

Description: List of 29 HEs identified in perilla population.

File Name: Supplementary Data 5

Description: List of 527 genic HEs.

File Name: Supplementary Data 6

Description: List of three de novo non-homeologous exchange events.

File Name: Supplementary Data 7

Description: Summary of the 191 perilla accessions.

File Name: Supplementary Data 8

Description: List of candidate genes involving in TAG biosynthesis.

File Name: Supplementary Data 9

Description: List of candidate genes involved in plant homologous crossover.

File Name: Supplementary Data 10

Description: List of candidate genes for essential oil biosynthesis in perilla.