

Description of Additional Supplementary Files

File Name: Supplementary Data 1

Description: Metabolite analysis results for promorphinan and morphinan compounds. (Source data are provided as a Source Data file)

File Name: Supplementary Data 2

Description: Presence of selected orthologous BIA biosynthetic genes in transcriptomic datasets and genome assemblies of Papaver species. (Source data are provided as a Source Data file)

File Name: Supplementary Data 3

Description: List of eight conserved ortholog sets (COS) genes from the RNAseq assemblies of nine Papaver species as well as annotated genome assemblies of six other Ranunculales species, *A. coerulea*, *E. californica*, *M. cordata*, *P. rhoeas*, *P. setigerum* and *P. somniferum*. (Source data are provided as a Source Data file)

File Name: Supplementary Data 4

Description: Percentage identity matrix between pairs of homologs of STORR, SALSYN, SALAT, SALR and THS in Papaver species. (Source data are provided as a Source Data file)

File Name: Supplementary Data 5

Description: Synteny analysis of STORR-containing contigs/scaffolds between opium poppy and other Papaver species. (Source data are provided as a Source Data file)

File Name: Supplementary Data 6

Description: Nucleotide sequences of yeast codon optimised full length STORR cDNAs from Papaver species.