Evolution of NADPH-cytochrome P450 oxidoreductases (POR) in Apiales - POR 1 is missing

The NADPH-dependent cytochrome P450 oxidoreductase (POR) is the obligate electron donor to eukaryotic microsomal cytochromes P450 enzymes. The number of PORs within plant species is limited to one to four isoforms, with the most common being two PORs per plant. These enzymes provide electrons to a huge number of different cytochromes P450s (from 50 to several hundred within one plant). Within the eudicotyledons, PORs can be divided into two major clades, POR 1 and POR 2. Based on our own sequencing analysis and publicly available data, we have identified 45 PORs from the angiosperm order Apiales. These were subjected to a phylogenetic analysis along with 237 other publicly available (NCBI and one KP) POR sequences found within the clade Asterids. Here, we show that the order Apiales only harbor members of the POR 2 clade, which are further divided into two distinct subclades. This is in contrast to most other eudicotyledon orders that have both POR 1 and POR 2. This suggests that through gene duplications and one gene deletion, Apiales only contain members of the POR 2 clade. Three POR 2 isoforms from *Thapsia garganica* L., Apiaceae, were all full-length in an Illumina root transcriptome dataset (available from the SRA at NCBI). All three genes were shown to be functional upon reconstitution into nanodiscs, confirming that none of the isoforms are pseudogenes.