



**Supplemental Figure S1. Phylogenetic tree of ancient XY gametologs and outgroup orthologs based on synonymous site divergences.** Phylogenetic tree based on synonymous site divergences ( $d_s$ ) of the concatenated XY oldest gametologs from *Anolis* (*RPL6* and *PPP1CC*) and concatenations of orthologous genes in 11 species. Key branch lengths ( $d_s$  values), species divergence times with 95% confident intervals and estimated origin of the sex chromosomes with 95% confident intervals (pink arrow) are indicated. Bayesian posterior probabilities at key nodes (based on phylogenetic tree reconstructions for entire coding sequences) are shown for statistical support of sex chromosome origin prior to the divergence of pleurodonts (*Anolis*/iguana) and acrodonts (*Pogona*; agamids). See Supplemental Figure S2 and S4 for results obtained with alternative phylogenetic reconstruction methods.