

New insight about the evolution of Dual oxidase genes (DUOX) in arthropods

Torres, A.Q.¹; Gandara, A.C.P.²; Oliveira, P.L.²; Schama, R.¹

¹Instituto Oswaldo Cruz, Rio de Janeiro, Brazil; ² Instituto de Bioquímica Médica Leopoldo de Meis, Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil.

INTRODUCTION: Dual oxidases (DUOX) are transmembrane proteins that belong to the NADPH-oxidase family and are responsible for reactive oxygen species (ROS) production. Within arthropods, DUOX plays its role in many biological processes such as, eggshell hardening and waterproofing, chitin-based cuticle development and host defense. This protein comprises four conserved domains along the amino acid sequence: EF-hand, peroxidase, transmembrane Ferric reductase and NAD_FAD binding. Recent phylogenetic studies revealed two DUOX paralogous genes in the ant species *Harpegnathos saltator* and *Camponotus floridanus*. However, it was not clear when the gene duplication event occurred and if both genes still share the same biological function or not. **OBJECTIVES:** Understand the evolution of the DUOX paralogous genes in arthropods. **MATERIAL AND METHODS:** All members of the NADPH-oxidase family (PF01794) were searched in ninety-one genomes of arthropods and fifteen from other metazoan using HMMsearch. Each sequence was submitted to CDD and Blastp searches against the UniProt database in order to identify DUOX proteins. Global alignment of all DUOX amino acid sequences was performed using MAFFT. A maximum likelihood tree was built using RAxML software with 500 bootstrap replicates. **RESULTS AND DISCUSSION:** Our phylogenetic analysis revealed that DUOX proteins were grouped in two clades that evolved independently (DUOX-Ecd and DUOX-met). DUOX-met contains both Ecdysozoa and other Metazoa genes that seem to have evolved from the DUOX gene that was present in the metazoan common ancestor. Within arthropods, DUOX-met genes were found in hymenopteran, coleopteran, odonatan, dipluran, crustacean and chelicerates. DUOX-Ecd is monophyletic and only comprised Ecdysozoa genes. The high bootstrap (95% of bootstrap) support indicates that this is a duplication that happened in the ancestral lineage of this group. **CONCLUSION:** Considering the evolutionary history of the DUOX-Ecd and DUOX-met and the low sequence identity, our results suggest that the ROS producing DUOX-met found in arthropods might play a different role in comparison to the well-studied DUOX-Ecd.

Keywords: Dual oxidase evolution, Arthropod DUOX, gene duplication, DUOX paralogous.

Support: CAPES