Multiscale analysis of the coral holobiont thermotolerance under contrasted thermal environment

Kelly Brener Raffalli*[1], Marine Pratlong†[2,3], Jérémie Vidal-Dupiol‡[4], Mehdi Adjeroud§[5], Pascal Romans¶[6], Rémi Pillot‖[6], Lionel Feuillassier**[6,7], Didier Aurelle††[8], Pierre Pontarotti‡‡[3], Anne Haguenauer[2], Guillaume Mitta[1], and Eve Toulza[1]

[1]Interactions Hôtes Pathogènes Environnements (IHPE) – CNRS : UMR5244, Université de Perpignan, Institut Français de Recherche pour l'Exploitation de la Mer (IFREMER), Organisation mondiale de la santé (OMS/WHO), Université Montpellier II - Sciences et techniques – Université de Perpignan 52 avenue Paul Alduy 66860 Perpignan Cedex, France

[2]Institut méditerranéen de biodiversité et d'écologie marine et continentale (IMBE) – INEE, Université d'Avignon et des Pays de Vaucluse, Institut de recherche pour le développement [IRD] : UMR237, Aix Marseille Université, CNRS : UMR7263, INSB, INSU – Aix Marseille Université, Campus Etoile, Faculté St-Jérôme case 421 Av. . escadrille Normandie-Niemen 13397 MARSEILLE CEDEX 20, France

[3]Evolution Biologique Modélisation – CNRS : UMR7353, Université de Provence - Aix-Marseille I – Aix-Marseille Université, CNRS UMR7353, équipe évolution Biologique et Modélisation, Campus Saint-Charles, 3 Place Victor Hugo 13 331 Marseille France, France

[4]IFREMER, département Ressources Biologiques Environnement, Unité ressources marines en polynésie française (IFREMER) – Institut Français de Recherche pour l'Exploitation de la Mer (IFREMER), CNRS : UMR241 – 4- UMR 241 Ecosystèmes Insulaires Océaniens, IFREMER / Centre du Pacifique, Département Ressources Biologiques Environnement, Unité Ressources Marines en Polynésie Française, BP 7004, 98719 Taravao, Polynésie Française, France

[5]ENTROPIE (ENTROPIE) – Institut de recherche pour le développement [IRD] : UMR9220 – Institut de Recherche pour le Développement, UMR 9220 ENTROPIE, Laboratoire d'Excellence "CORAIL", UPVD 52 Avenue Paul Alduy, 66860 Perpignan, France, France

[6]Université Pierre et Marie Curie - Paris 6 (UPMC) – Université Pierre et Marie Curie (UPMC) - Paris VI : UM2348 – Sorbonne Universités, UPMC Univ Paris 06, UMS 2348, Centre de Ressources Biologiques Marines, Observatoire Océanologique, F-66650 Banyuls/Mer, France, France

[7]Diversité, adaptation, développement des plantes (DIADE) – Institut de recherche pour le développement [IRD] : UR232, Université Montpellier II - Sciences et techniques – Centre IRD de Montpellier 911 av Agropolis BP 604501 34394 Montpellier cedex 5, France

[8]Institut méditerranéen de biodiversité et d'écologie marine et continentale (IMBE) – Aix-Marseille Université - AMU, CNRS : UMR7263 – UNIVERSITE PAUL CEZANNE AIX-MARSEILLE 3 Case 451 Av. escadrille Normandie-Niemen 13397 MARSEILLE CEDEX 20, France

Abstract

In the context of global change, corals are being submitted to an increase in sea surface temperatures that is reaching values they never experienced in their lifetime. In order to better predict the future of these animals of great ecological importance facing this unusual thermal stress, we started an integrative approach to better understand acclimation as well as adaptive response potential. In this work, we performed a multiscale comparative thermotolerance experiment for two coral species: *Pocillopora damicornis*, a tropical scleractinian coral, and *Corallium rubrum*, a temperate coral from the Mediterranean Sea. For each of these species, we compared the response to thermal stress for two populations that have experienced in their life history contrasted thermal regimes (high or low annual thermal variations), and for distinct individual genotypes of each population. We considered the holobiont coral entity, *i.e.* the cnidarian itself, its associated microbial community and the symbiotic zooxanthellae (for *P. damicornis*). We followed the transcriptomic response of the cnidarian host using RNAseq, and the dynamic of the microbiota (using 16S metabarcoding) as well as the zooxanthellae (using ITS barcoding) until the upper limit of thermotolerance and for the different species / populations / genotypes. These comparative, multiscale analyses of the thermal stress response of the coral holobiont will allow us to identify potential convergent molecular mechanisms existing between these two ecologically and phylogenetically distant species, as well as specific pathways within the same species between populations experiencing different thermal regimes.

Keywords: Coral, Pocillopora damicornis, Corallium rubrum, Symbiodinium, microbiota, thermotolerance, holobiont, RNAseq, metabarcoding, zooxanthellae

*Speaker
†Corresponding author: marine.pratlong@imbe.fr
‡Corresponding author: Jeremie.Vidal.Dupiol@ifremer.fr
§Corresponding author: mehdi.adjeroud@ird.fr
¶Corresponding author: pascal.romans@obs-banyuls.fr
‖Corresponding author: pillot@obs-banyuls.fr
**Corresponding author: feuillassier@obs-banyuls.fr
††Corresponding author: didier.aurelle@imbe.fr
‡‡Corresponding author: pierre.pontarotti@univ-amu.fr
Corresponding author: anne.haguenauer@imbe.fr
Corresponding author: mitta@univ-perp.fr
Corresponding author: eve.toulza@univ-perp.fr