Geophysical Research Abstracts
Vol. 13, EGU2011-3114, 2011
EGU General Assembly 2011

Decapod crustaceans from deep-sea wood falls in the South Pacific Ocean: diet, trophic level and symbioses.

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Overlooked for a long time, wood falls on the deep oceanic floor are now recognized as an important food source sustaining particular extreme, chemosynthesis-based ecosystems those of hydrothermal vents, cold seeps and whale falls with which they share important physicochemical and faunal similarities. In these ecosystems, the bacterial chemosynthesis using reduced compounds (H2S, CH4) and/or the digestion of refractory organic compounds (cellulose, lignin, bone matrix,...) by heterotrophic bacteria play an essential role in the trophic network and appear to promote the establishment of mutualistic symbioses between bacteria and metazoans for the exploitation of environmental resources. In spite of the numeric dominance of wood-boring and grazing mollusks, the importance of wood-feeding decapods crustaceans such as galatheid crabs (Munidopsis andamanica) was pointed out in a recent paper (Hoyoux et al., 2009, Mar. Biol., 156, 2421-2439). This species harbours a resident gut microflora probably helping in the digestion of wood. However, very little is known about the other decapod crustaceans also regularly collected during oceanographic cruises.
The present work (Hoyoux, 2010, PhD thesis, ULgetd-11242010-182425, 343.) is focused on 15 decapod species collected on wood falls in the South Pacific Ocean by several french cruises near the Vanuatu, Solomon Island and New Caledonia. Their diet, trophic level in the ecosystem and microbial associations were determined by use of microscopic (TEM, SEM), stable isotopes (C and N) and molecular approaches.
In addition to a non-exhaustive inventory of the best represented species, the results provide four informations. (1) Most of the decapods from sunken woods belong to the Anomoura (galatheid, pylochelid and pagurid crabs) and to the thalissinid shrimps ("mud shrimps"); some species (e.g. Munidopsis) belong to deep-sea taxa while others (e.g. Xylopagurus) are closer to shallow-water species suggesting that the colonization of wood falls by decapods may have occurred from both deep and coastal habitats. (2) From a trophic point of view, the data provides a new tentative model of the wood fall ecosystem in which the decapods are classified in four trophic guilds (levels) depending on two primary food sources, the wood and the particulate organic matrix ("ocean snow"). Two of these guilds gather the half of the species that are xylophagous detritivores (M. andamanica, Raylianassa amboinensis) and bacteriovorous detritivores (M. nitida, M. pilosa, M. bispinoculata) and feed directly or indirectly on wood. These data highlight the importance of xylophagous decapods in the ecosystem and break with the widespread idea that decapods from wood falls are all scavengers or predators. (3) Potentially symbiotic associations with resident microorganisms (bacteria and/or trichomycetes) were observed in the hindgut of five species and appear to be linked to a "wood-based" diet. (4) Cloning and sequencing 16S rRNA genes from the gut bacteria of M. andamanica reveals that the resident hindgut microflora is largely dominated by two phylotypes (OTUs) of eubacteria (Firmicutes and Alphaproteobacteria) that are very close to gut bacteria isolated from a coastal decapods (N. californiensis and E. sinensis). This strongly supports the idea that the resident bacteria in the gut of M. andamanica are very probable digestive symbionts and suggests that they are specific gut bacteria of crustaceans.
The results raise the questions of the development and evolution of digestive symbioses in crustaceans in relation with the diet and/or with the adaptation to a special habitat contrasting with the permanent re-acquisition of symbionts from the medium.

The authors thank the belgian founds FNRS-FRIA and the french institutes (CNRS and IFREMER) for their financial support. Thank to the crew of RV ALIS (IRD) and P. Bouchet (MNHN-Paris), principal investigator of the research programme "Tropical Deep-sea Benthos".