Exploring changes in bacterioplankton community structure in response to tannic acid, a major component of litterfall, in a mangrove ecosystem: a laboratory mesocosm approach

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Litterfall constitutes a major source of allochthonous matter for bacterioplankton communities in estuarine mangroves. Tannic acid, an abundant component of mangrove litterfall, leaches out and contributes substantially to DOC and DOM pools of the adjacent estuaries. About 50% of mangrove litterfall maybe degraded and channelized into the marine microbial loop. Estuarine conditions of Sundarbans, world’ s largest contiguous mangrove, was mimicked in a laboratory mescocosm set-up using barrels to understand the influence of tannic acid on bacterioplankton communities. Estuarine water from a station, Stn3 of Sundarbans Biological Observatory Time Series (SBOTS) was enriched with tannic acid and the change in functional bacterioplankton community structure was analysed on the start (Day 0), intermediate (Day 7) and end (Day 15) of the experiment. Bacterioplankton community structure was elucidated by sequencing the V3-V4 region of 16S rRNA on an Illumina MiSeq platform. Concentration of tannic acid, gallic acid, trace elements, dissolved nutrients such as nitrate and *ortho* -phosphate along with hydrological parameters were determined on a daily basis. Degradation of tannic acid was tracked by decrease in concentration of tannic acid and generation of gallic acid, one of the final products of tannic acid degradation. Tannic acid was shown to significantly affect the concentration of dissolved nitrate and trace elements in the barrels. Proteobacteria was found to be the most dominant bacterial phylum in Control and tannic acid enriched barrels (Barrel 1 and 2) on Day 0. With the progression of experiment, the abundance of Proteobacteria decreased significantly in the Control barrel indicating the dependence of this phylum on steady flux of nutrients. The abundance of Proteobacteria in the tannic acid enriched barrels remained high indicating that members of Proteobacteria may be capable of using tannic acid as a source of carbon and nitrogen. Tannic acid appeared to inhibit other bacterioplankton phyla including Actinobacteria, Acidobacteria and Verrucomicrobia that existed in large abundance in the Control barrel on Day 15 but were absent in the tannic acid enriched barrels. At class level, Bacteroides was found to be present in highest abundance in the tannic acid enriched barrels. Bacteroides are capable of breaking down tannic acid using tannase as an enzyme. This experiment indicated that bacterioplankton communities of Sundarbans could harbour genes necessary for breakdown of complex components of litterfall and recycle them into the marine microbial loop. Breakdown of tannic acid could influence the marine nitrogen and carbon cycling by releasing DON and DOC respectively into the adjacent estuaries. An understanding of the breakdown of tannic acid and other components of mangrove litterfall and its influence on the resident biological communities of estuarine mangroves could be essential for our understanding of functioning of coastal ecosystems.

Keywords: bacterioplankton, mangrove, litterfall