Bacterial communities in rainwater associated with different synoptic weather systems at a site in Kumamoto, southwestern Japan

*Wei Hu[1], Kotaro Murata[1], Daizhou Zhang[1]

1. Prefectural University of Kumamoto

Bacteria substantially exist in rainwater and can be disseminated by rain from the atmosphere to the earth's surfaces, on the one hand driving the development and evolution of ecosystems, but on the other hand causing great concern for their potential negative impacts on environments and public health. However, studies of bacterial communities in rainwater, especially those dependent on different synoptic weather systems, are largely lacking. In this study, rainwater samples were collected at a site (32.806°N, 130.766°E) in Kumamoto, southwestern Japan. Samples from four cases of each rain types of cyclone-, Meiyu (plum rain) front- and non-Meiyu stationary front-associated rains, and samples from three cases of typhoon-influenced rains were analyzed. The abundance of bacteria in these rainwater samples was $0.8-4.6\times10^4$ cells ml^{-1}, and the viability (the ratio of the abundance of bacteria with intact cell membranes to that of total bacteria) was 66–91%. Bacteria in the rainwater of cyclones, in accompany with the intrusion of continental air, were characterized by high abundance and low viability. In other cases of rain, when clouds were significantly affected by marine air, the concentration of bacteria was low and the viability was high. Bacterial communities in rainwater, identified by using 16S rRNA gene sequencing, were dominated by *Proteobacteria*, *Cyanobacteria*, *Bacteroidetes*, *Firmicutes* and *Actinobacteria* phyla. Diverse bacterial communities were appeared in four types of rainwater samples, and about half of the phyla (17 out of 35) were common in different types of rainwater. The presence of ice nucleation-active bacteria, such as the members of the genera *Pseudomonas*, *Xanthomonas* and *Erwinia*, indicate bacteria as nuclei in clouds were a potential source of bacteria in rainwater. Marine bacterial taxa, e.g., *Pseudoalteromonas*, *Synechococcus* and *Marinobacter*, were detected in rainwater samples, showing that marine bacteria were dispersed via cloud or rainwater.

Keywords: Bacteria, Community composition, 16S rRNA sequencing, Rainwater, Synoptic weather