ARI Scientists Study methane-oxidizing bacteria for methane mitigation and value addition

Scientists at Agharkar Research Institute (ARI), Pune, an autonomous institute under the Department of Science & Technology, have isolated 45 different strains of methanotrophic bacteria which have been found to be capable of reducing methane emissions from rice plants.

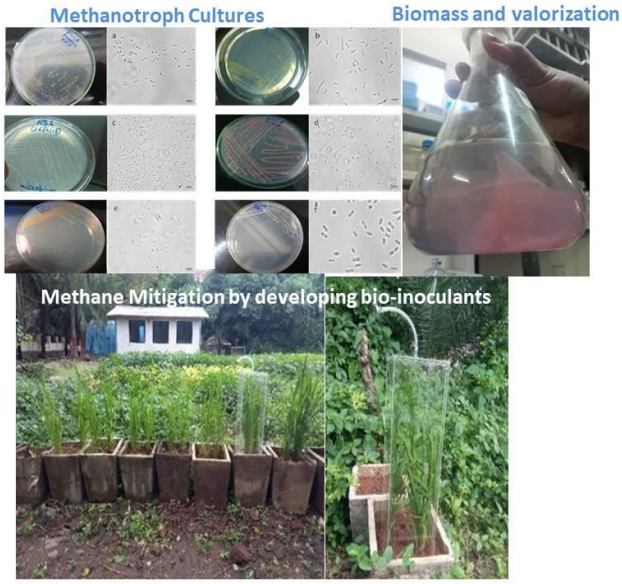
Methanotrophs metabolise and convert methane into carbon-di-oxide. They can effectively reduce the emission of methane, which is the second most important greenhouse gas (GHG) and 26 times more potent as compared to carbon-di-oxide. In rice fields, methanotrophs are active near the roots or soil-water interfaces.

Dr. Monali Rahalkar, Scientist from Bioenergy Group, ARI, and her team working on methanotrophs, have enriched, isolated, and cultivated the 45 different strains of methanotrophs and created the first indigenous methanotroph culture. In their work published in Antonie van Leeuwenhoek, an International Journal of General and Molecular Microbiology, they isolated indigenous methanotrophs from Western and Southern India, mainly from rice field soils and freshwater mud and have documented two novel genera and six novel species of methanotrophs from rice fields in Western India. In pot trials, some of the strains were used as bio-inoculants in rice plants.

The team found that there was a decrease in methane emissions in inoculated plants with a positive or neutral effect on the growth of the rice. This could lead to the development of microbial inoculants for methane mitigation in rice.

Rice fields are human-made wetlands and are waterlogged for a considerable period. Anaerobic degradation of organic matter results in the generation of methane. Rice fields contribute to nearly 10% of global methane emissions. Very few studies in the world have focused on methanotrophs from tropical wetlands or tropical rice fields.

Before scientists at ARI started their studies, practically no cultures of indigenously isolated methanotrophs from India were available. Native and relevant methanotrophs isolated from rice fields can be excellent models to understand the effect of various factors on methane mitigation. Ammonium fertilizers, increasing temperatures (due to global warming) are some of the important factors which the team plans to study in the future.



Various methanotrophs on culture media (upper left)
The dark pink color biomass from methanotrophs which is a rich source of carotenoids, single-cell proteins leading to methane valorization (upper right) Preliminary experiments indicated that when methanotrophs were inoculated rice plants showed lower methane emissions, higher methane oxidation potential and better/ neutral effect on plant growth (lower panel
Plastic chamber to measure methane emissions is shown (lower right)

Besides methane mitigation studies, methanotrophs can also be used in methane value addition (valorization) studies. Bio-methane generated from waste can be used by the methanotrophs and can be converted to value-added products such as single-cell proteins, carotenoids, biodiesel, and so on. The team is further working on methane valorization studies from the isolated methanotrophs. Such studies help reduce GHG emissions, especially anthropogenic or man-made emissions, which a pressing need in the age of global warming.