GLOBAL MEET ON CLIMATE CHANGES AND SUSTAINABILITY

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Pesticides pollution: Ecotoxicological Studies and Environmental Risk Assessment

Abstract: The introduction of pollutants like thiacloprid, benzo[a]pyrene (B[a]P), glyphosate, and imidacloprid into urbanized coastal and estuarine waters through fossil fuel spills, waste discharges, atmospheric inputs, and runoff poses significant threats to aquatic life. This study evaluates the developmental toxicity and oxidative stress these pollutants induce in marine and freshwater organisms. For the first time, monoclonal and polyclonal anti-Toll-like receptor 2 (TLR2) and anti-inducible nitric oxide synthetase (iNOS) antibodies were employed to examine hemocytes in the mantle and gills of Mytilus galloprovincialis as biomarkers of thiacloprid and B[a]P pollution. Samples were exposed to the pollutants individually and in combination. Oxidative stress biomarkers were assessed enzymatically, while tissue changes and hemocyte counts were evaluated via histomorphological and immunohistochemical analyses. Results showed that combined exposure to thiacloprid and B[a]P significantly elevated oxidative stress compared to single exposures, indicating a synergistic effect. Moreover, the developmental toxicity of glyphosate and imidacloprid was investigated in zebrafish (Danio rerio) embryos exposed to glyphosate (250 µg/L) and imidacloprid (30 µg/L) from 0 to 96 hours post-fertilization using the fish embryo toxicity test (FET). Both single and combined exposures impacted survival, hatching rate, morphology, and body length. The antioxidant defense system was significantly disrupted, and apoptosis increased in zebrafish larvae. Expression changes in inflammation-related and apoptosis-related genes were noted, suggesting time-dependent developmental toxicity due to glyphosate and imidacloprid exposure. Our findings enhance understanding of TLR2 and iNOS roles in bivalve defense systems and highlight the developmental risks of pesticide contamination in aquatic environments. These insights could aid in developing new technologies and strategies, such as biosensors, for improved water pollution management and marine ecosystem health assessment.

Biography: Dr. Davide Di Paola is a researcher in Ecology at the University of Messina, specializing in chemical, biological, pharmaceutical, and environmental sciences. He has collaborated with national and international research groups, contributing to over 35 peer-reviewed publications. He holds a Ph.D. in Applied Biology and Experimental Medicine and has expertise in studying effects of environmental contaminants on aquatic organisms. Dr. Di Paola serves as a guest editor and reviewer for multiple scientific journals. He has presented his research at various prestigious conferences and led several environmental projects.

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