Invertebrates facing environmental contamination by phthalates: novel evidences and recent insights

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Abstract

Phthalates are synthetic contaminants released into the environment notably by plastic waste. Semi-volatile and highly lipophilic, they adsorb to organic matter into sediments and stick to volatile organic compounds, getting distributed in all ecosystems. Effects of this major anthropogenic pollution on human and on economical species have attracted large interest, leading to the recognition of phthalates as endocrine-disrupting chemicals. However, very few studies have focused on wild unexploited populations. In two independent studies on wild invertebrate models, we highlight the fact that terrestrial invertebrates and especially insects are more exposed to phthalates than previously thought: the lipophilic nature of the cuticle makes it a good trap for atmospheric phthalates, leading to permanent presence of these molecules onto the insect body. We showed that such basal chronic contamination probably has deleterious effects on the ant *Lasius niger*, reducing queen fertility and disturbing immune functions in workers. Furthermore, we evidenced subtle effects of living in a phthalate-contaminated milieu in the sand-dwelling marine worm *Hediste diversicolor*. While chemical analyses of the sediments predicted no acute toxicity for the worms, and phenological studies evidenced no direct cost for the studied populations, we evidenced that both populations exposed to multiple pollution (high phthalates + high metals) or to phthalates alone (medium levels of phthalates) showed a significantly reduced survival upon infection with a local pathogen, compared to a reference population (low levels of phthalates). Moreover, the females living in polluted areas (medium and high) seem to protect less efficiently their descent: their oocytes contain less antibacterial molecules active against local bacterial strain. Generalized exposure and subtle negative effects should prompt us to deeper investigate the consequences of such ubiquitous environmental contaminants on invertebrate natural populations.

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