MSc in Environmental Contamination and Toxicology EMJMD
UPV/EHU – UBx – ULiège
UPPA – NTNU – UPO
an Erasmus+ Consortium
www.ectplus.eu

Co-funded by the Erasmus+ Programme of the European Union

MASTER THESIS PROJECT

Combined effects of microplastics and drought on terrestrial plants

DUSHMNTHA NAMAL KOKU HANNADIGE ABEYSOORIYA

Institute of Environmental Sciences (CML), Leiden University,

Leiden, The Netherland

PLENTZIA (UPV/EHU), JULY 2022

Universidad del País Vasco Euskal Herriko Unibertsitatea
université de BORDEAUX
UNIVERSITÉ DE PAU ET DES PAYS DE L'ADOUR
LIÈGE université
NTNU Norwegian University of Science and Technology
U.PORTO

Combined effects of microplastics and drought on terrestrial plants

Namal K.H.AD [2] , Zantis L.J [2] & Bosker T [1,2]

[1] Leiden University College, Leiden University, P.O. Box 13228, 2501 EE, The Hague, The Netherlands
[2] Institute of Environmental Sciences, Leiden University, P.O. Box 9518, 2300 RA Leiden, The Netherla

SUMMARY

There is growing concern regarding the combined effects of microplastics (MP) with other global change stresses on terrestrial plants. The impacts of biodegradable(bMP) and conventional(cMP) microplastics on drought stress on terrestrial plants are understudied. Therefore, in this study, the impact of soil contaminated with five different concentrations (0.05%; low, 0.2%; medium, 0.8%; high and 3.2%; very high) of bMP (polybutylene adipate terephthalate or PBAT) and cMP (low density polyethylene or PE) under two different water conditions (70% = well-watered and 50% = drought) on the germination rate and growth of lettuce (*Lactuca sativa*) and barley (*Hordeum vulgare*) was investigated. Soil was mixed with different amounts of MP under two watering strategies in separate pots for each treatment. Seeds and plants were subjected to 27 days of testing to determine acute and chronic effects on germination, shoot length, root length, number of leaves, and dry weight. Only in lettuce we found that the interaction between plastic type, plastic concentration, and water level was significant (three-way MANOVA; p 0.01). For both acute and chronic exposure of MP, in well water conditions, the highest significant mean value of all growth endpoints and % germination was observed in barley and lettuce with very high concentrations (3.2%) of cMP and a high concentration of bMP (0.8%) conditions, respectively. For both plants, the lowest growth endpoint and % germination values were recorded under the drought condition, but with various MP types and plastic concentrations depending on time. We concluded that growth endpoints for acute and chronic drought stress and MP showed distinct significant changes with different MP types and MP concentrations depending on time (either an increase or decline, or vice versa). This is the first comparative study of the combined effects of biodegradable and conventional microplastics with drought stress, hence the findings are important.

Key Words: Microplastics; Drought stress; Terrestrial plants; Seed germination; Combined effects