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The selective bioherbicide action of a microalgae isolated from a Portuguese soil

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Abstract

Background: To meet the food needs of the world's expanding population without compromising environmental quality, it is necessary to use eco-friendly bio-resources to boost agricultural production and soil fertility. The eukaryotic microalgae and cyanobacteria present in biological soil crusts are highly adaptable photoautotrophic microorganisms [1,2]. Their ability to produce a wide range of bioactive compounds with potential biostimulant or bioherbicide allows for various agricultural uses. Despite their significance for sustainable agricultural growth, there are few studies on their application as bioherbicides to combat the weeds that reduce crop productivity [3].
Objective: In this work, we investigated the mode of action of a microalga from the genus *Klebsormidium* that was isolated from Portuguese soil with the aim of being able to be used in agriculture. **Methods:** Seeds of monocotyledonous and dicotyledonous plants were germinated in petri dishes with solid nutrient medium, inoculated with microalga exudates and the biometric parameters were evaluated. **Results**: The results showed a selective herbicide effect of *Klebsormidium* sp, inhibiting the growth of dicotyledonous plants: Arabidopsis and Nicotiana, and having no effect on monocotyledonous species: *Lollium*, barley and maize. Plants of species with different sensibilities were chosen to grow in pots and some biochemical parameters were assessed, such as the enzymatic and non-enzymatic antioxidant system, the activity of the nitrogen metabolism and plant growth-related parameters such as the chlorophyll, proteins, sugar and starch contents. The metabolism of the monocotyledonous plants was not significantly affected by *Klebsormidium* sp., whereas the most sensitive species, dicotyledonous, showed chlorosis and necrosis due to cellular damage from stress. Sensitive plants relied on non-enzymatic antioxidant defenses, which were insufficient to cope with the consequences caused by the microalga, while the most resistant plants were able to activate the enzymatic antioxidant system to mitigate the algae effects. **Conclusions:** This study allows for a better understanding of the mode of action of *Klebsormidium* sp on plants, contributing to a better comprehension of the molecular mechanisms underlying the interactions between photoautotrophic microorganisms in soil and plants opening new avenues for the development of sustainable alternatives to chemicals currently used in agriculture and in the recovery of damaged soils.

Keywords: *Klebsormidium* sp; stress; sustainable agriculture

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