Exploring frass deriving from *Hermetia illucens* as a new sustainable tool for inducing biostimulant and antifungal activities in wheat and tomato against *Fusarium* spp.

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Hermetia illucens (Diptera: Stratiomyidae) is commonly used as a bioconverter insect of organic wastes during its larval stage in order to obtain chitin and its derivative and foster the circularity of the agri-food sector. The residual material of this bioconversion process by black soldier fly larvae, composed of larval excreta, exuviate and uneaten feedstock, is known as frass. It is rich of macro- and micro-nutrients and, for this reason, it can be considered as a secondary by-product usable as a sustainable alternative to chemical fertilizers. In addition, frass, similarly to compost and vermicompost, can have suppressive effects against some phytopathogenic fungi. In the current study, frass from *H. illucens* pupae reared on the Gainesville diet under standard conditions was investigated by *in vitro* and *in vivo* studies to assess its biostimulant and antifungal properties. The *in vitro* assay demonstrated that the frass aqueous extract (FAE) added in the media was able to stimulate the germination of seeds of the test plant cress (*Lepidium sativum* L.), never being phytotoxic. In addition, FAE inhibited the mycelial growth of the soil-borne pathogens *Fusarium oxysporum* f.sp. *lycopersici* and *F. sporotrichioides* of 30% and 49%, respectively. Moreover, when synergistically used with other antagonists, such as *Trichoderma harzianum*, FAE did not disturb their effectiveness in controlling phytopathogenic fungi. Germination tests on tomato (*Solanum lycopersicum* L. var *cerasiforme)* and durum wheat (*Triticum durum* Desf. var *Simeto)* seeds infected with the same above-mentioned fungi indicated that FAE was able to induce antifungal and biostimulant effect, especially with regard to lateral roots branching and radicle length in tomato and wheat, respectively. In conclusion, our results open the door for further researches for implementing frass as a green, circular economy-based and sustainable tool to be used in agriculture systems.

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