Plants, as permanently attached to the ground, had to develop defence mechanisms and communication systems, which could compensate the movement inability. These adaptations may be comprised by producing and emitting a range of chemical compounds, which could act as repellents, attractants or signalling agents. The group of possible mediating agents is broad and includes root exudates but also volatile organic compounds (VOCs). The profile of emitted volatile compounds, including VOCs and essential oils, is called plant volatilome.

Nowadays, it is becoming more and more evident that soil-dwelling insect herbivores can use VOCs present in the vicinity of plant roots as cues for host localization and foraging. The project aims at understanding how this relationship functions for the system composed by strawberry (*Fragaria* x *ananassa* Duchesne) and European cockchafer (*Melolontha melolontha* L.) larvae. Strawberry has a world-wide economic importance, being produced commercially in 77 countries on all continents, which makes its fruit the most popular berry fruit in the world. A continuous effort is provided by research to understand the biology and physiology of this species, and to enhance its productivity, with particular attention to the protection against pests. On the other hand, *M. melolontha* is an increasingly important root feeding pest of strawberry and other horticultural crops in Poland and other European countries. Moreover, to the best of our knowledge, no research has been carried out about the belowground strawberry-insect interaction or about the volatile compounds which could be emitted or present in the vicinity of strawberry roots. All this makes strawberry-*M. melolontha* an interesting pest-host plant model to unravel and better understand the mechanisms and factors involved in the relations between plants and soil-dwelling insect herbivores.

The project objectives will be achieved by: (a) identifying the profiles of underground VOCs present in the vicinity of strawberry plants by chromatographic analyses and (b) studying the influence of different experimental conditions on the feeding behaviour of *M. melolontha* larvae. All of the experiments will be carried out in controlled conditions either in laboratory or in greenhouse. We are planning to study the impact of: different substrates used for plant cultivation, different strawberry developmental stages (plants before flowering, flowering plants and fruiting plants) or different abiotic (nutrient regime) or biotic stress (herbivorous attack) conditions on both the emitted VOCs profiles and *M. melolontha* larvae feeding preferences. The study comprises also assessing the background portfolio of volatile compounds of non-plant origin (microbiome associated with soil or other substrate, soil or substrate itself and *M. melolontha* larvae), which could also affect the pest-host plant interaction. Outcomes of these experiments will be used to develop a model correlating larvae behaviour with identified VOCs, which will be crucial for verification of the project hypothesis.

The project will use special self-constructed experimental set-up, enabling undisturbed observation of the plant root system and larvae movement, together with VOCs sampling without disturbing the air balance in the soil. Thus, constituting system that highly imitates the natural conditions and is suitable for assessing complex plant-environment interactions.

The project represents the first multifunctional approach, combining biochemical and plant-insect-level studies, able to provide a better understanding of the belowground plant-environment interactions, applying innovative and pioneering methodologies in the field of horticultural sciences. The methods developed during the project, particularly those related to the collection of VOCs from soil-air fraction and the behavioural analysis of larvae under contrasting conditions, could lead to the development of innovative approaches useful to better understand basic mechanisms in the relation of the plant with the soil environment. Moreover, data and knowledge obtained during the project could be the foundation for building a horticultural database of plant-related belowground VOCs, which can be interlinked with other databases useful for plant physiology and microbiology studies.

The project, by shedding more light on the interactions of the plant with surrounding environment could determine an evolution of plant control strategies towards more sustainable and pro-ecological solutions. Understanding the pest feeding preferences by identifying the olfactory cues and the mechanisms of host plant localization, can support a proper manipulation of these processes from horticultural and agronomical standpoints.