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BOOK OF ABSTRACTS

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Attraction of a parasitoid to volatiles of Zambian maize accessions attacked by the fall armyworm

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The fall armyworm (FAW, *Spodoptera frugiperda*) is an invasive pest present in Africa since 2016, causing substantial losses in maize yields. In this new ecosystem, indigenous parasitoids have been identified that can use FAW as a host, such as the larval endoparasitoid wasp *Cotesia icipe*. These natural enemies have the potential to be used in biological control strategies, as alternatives to the excessive and harmful use of synthetic pesticides. Like many other parasitoids, *C. icipe* likely uses herbivore-induced plant volatiles (HIPVs) to locate hosts. If so, its biological control potential may depend on selecting the right maize variety, one that releases highly attractive HIPVs under FAW attack. With this in mind, we used ten maize accessions from Zambia to test whether (*i*) the accessions differ in HIPVs emissions upon FAW larvae attack, and whether (*ii*) the accessions differ in their attractiveness to naïve parasitoid females of *C. icipe*. For this, we collected, analysed and compared the FAW-induced volatiles of the ten accessions. We found that the HIPVs blends differed considerably in quantity but also in composition. While green leaf volatiles were emitted in similar quantities by all accessions, there were significant differences in emission of terpenoids, with some accessions emitting large quantities, some accessions emitting low quantities, and some accessions emitting only low quantities of mono- and sesquiterpenes but higher amounts of homoterpenes. Accessions with overall high terpenoid emissions also emitted more linalool and indole. To test the attraction of *C. icipe* towards the HIPVs, a 6-arm olfactometer was used. Three of the maize accessions were consistently more attractive to *C. icipe* females than the other accessions. Among the three most attractive accessions, the volatile profiles were highly variable with one accession emitting overall high quantities of volatiles and the two other accessions emitting smaller quantities of volatiles, indicating that the parasitoids are not simply attracted to large quantities. Additional assays are underway to more precisely pinpoint the reason for the differential attractiveness. Choosing an attractive maize accession could be an effective strategy to increase the effectiveness of *C. icipe* in the biological control of FAW larvae.

Keywords: *Tritrophic interactions; larval endoparasitoid; herbivore-induced plant volatiles*

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Odor sensors to detect and identify agricultural pests for crop protection

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Plants respond to biotic stress by releasing specific blends of volatile compounds. Particularly intriguing are the so-called herbivore-induced plant volatiles (HIPVs), which various plants release in large quantities when they are attacked by herbivores. Natural enemies of herbivorous pests may use these plant-provided signals to locate plants with potential prey or hosts. Currently, there is an urgent need to develop agricultural technologies with less detrimental environmental impact, such as reducing the excessive use of harmful agrochemicals. An early and precise detection of attackers would be a way to drastically reduce the need for pesticides because by knowing exactly when an individual plant is being attacked, and by whom, could help farmers to take control measures promptly and accurately. In the current study, we tested whether odor-sensor devices could be applied for this purpose. We addressed the question whether plant odors can be used to monitor the presence of pests and diseases on crop plants. For this, we sampled volatiles from healthy plants, plants infected with the anamorphic fungus *Glomerella graminicola*, and plants infested with caterpillars of the lepidopteran pests *Spodoptera frugiperda* or *S. exigua*. This was done with two commercial hybrids of maize, Delprim and Aventicum. Using two techniques, one involving piezoresistive membrane surface stress sensors and the other proton-transfer reaction mass spectrometry, we found that, under laboratory conditions, both techniques distinguished with 80 to 90% accuracy, between maize plants that were either healthy, infested by caterpillars, or infected by a fungal pathogen. Under field conditions, the mass spectrometry sensor was readily able to recognize plants with simulated caterpillar damage from undamaged plants. In addition, a deep-learning model using the Extreme Gradient Boosting algorithm could predict the damage status of a plant with an average accuracy of up to 80%. With these two very distinct odor detection devices we demonstrate the feasibility of developing real-time pest-infestation diagnostics based on plant volatiles.

Keywords: *Volatiles; agriculture; sensors*