PROJECT DELIVERABLE REPORT

Deliverable D3.01: Improved and tested Delta and McPhail e-Traps and image analysis software

Fruit Flies In-silico Prevention & Management

FF•IPM

Project Title:

In-silico boosted, pest prevention and off-season focused IPM against new and emerging fruit flies ('OFF-Season' FF-IPM)

SFS-2018-2

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1 Summary

The aim of deliverable 3.1 (Task 3.3, Work Package 3) was to improve, advance and adapt two e-traps prototypes (McPhail and Delta) developed in previous projects for application in Task 5.2 (Work Package 5 of the FF-IPM project) and for its future commercialization. The advanced prototypes developed in T3.3 included a sorting image analysis algorithm to discern and correctly identify the three target fruit fly species, and between the fruit fly species and other insect attracted and trapped by the McPhail e-trap. The image analysis algorithm was developed using deep-learning tools (specifically, R-CNN ResNet50). Images for training derived from two sources: the "FF photographic studio", which produced images from laboratory specimens, and from field images obtained from a field evaluation of the McPhail e-trap in several locations. The resulting trained algorithm had a very high precision, and accuracy, and is able to satisfactorily classify the target fruit flies and other insects. The McPhail e-trap and image analysis performance were field-validated during June 2021 in Israel, for *Ceratitis capitata* and *Bactrocera zonata*. Validation of *B. dorsalis* was done with field images collected during October-2020 and January 2021 in South Africa. The system (image uploading and image processing) is currently installed in UTH server and is ready for T5.2.

The McPhail and Delta e-traps were adapted to the project by compacting the traps into a more versatile prototype. The e-traps were field evaluated during 2020-early 2021. The McPhail e-trap was tested in several locations: Greece (UTH), Italy (UNIMOL), Austria (AEGES), South Africa (CRI) and Israel (ARO). The evaluation included the ability of the e-trap to communicate information autonomously and automatically from the field, and its ability to attract and trap the three fruit fly species target of FF-IPM (the Delta trap was only evaluated for *C. capitata*). The McPhail e-trap was effective to attract and trap *C. capitata* males (using trimedlure as attractant) and *B. dorsalis* (using Methyl Eugenol as attractant) in comparable numbers to the conventional traps. Regarding *B. zonata* males attracted with Methyl Eugenol, attraction was 1/3 lower than the conventional trap. This probably due to a difference in the design between the McPhail e-trap and the conventional Steiner trap, which has lateral accesses for attracted flies. This aspect may be enhanced in the future. The cellular communication ability in all locations was relatively good, and the Early-Warning ability (i.e., the ability to provide information in anticipation to the scout) was very good. That is, the McPhail e-trap provided Early Warning information to the decision makers with large anticipation to the one provided by the scout.

The Delta e-trap was tested for *C. capitata* in Italy (UNIMOL) and Greece (UTH). The evaluation included the performance of the trap in terms of transmission of images and power autonomy, and its ability to attract and trap *C. capitata* males, using as attractant trimedlure. Results showed that, taking two photos per day, the solar panel is able to maintain the electronic functioning of the trap. Furthermore, the trap catches were higher when compared to the conventional delta traps (but not significantly different).

The two optimized traps will be also considered in the T5.2 of FF-IPM. For the McPhail e-trap the automation of the system is now functional in the project platform, and is ready to acquire uploaded images, process them and extract numerical information from each e-trap and location to drive Dymex and Climex. The Delta e-trap, for which the automatic image recognition was not tested, will be incorporated into the system with a semiautomatic count of FF.

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