Identification of volatile organic compounds as markers to detect *Monilinia fructicola* infection in fresh peaches

Benedetta Fanesi [1], Annamaria Lucrezia D'Ortenzio [1], Anastasiya Kuhalskaya [1], Ancuta Nartea [1], Dennis Fiorini [2], Marwa Moumni [1], Lucia Landi [1], Paolo Lucci [1], Gianfranco Romanazzi [1], Deborah Pacetti [1]

[1] Department of Agricultural, Food and Environmental Sciences, Università Politecnica delle Marche, 60131, Ancona, Italy
[2] School of Science and Technology, Chemistry Division, Università di Camerino, 62032, Camerino, Italy

INTRODUCTION

The maintenance of high-quality standards for prolonging the shelf life of fruit is a priority for horticultural products, and fungal infection is one of the main problems of peach fruit in postharvest. The main pathogen of these crops is *Monilinia* spp., which causes brown rot. Development of solutions that can provide an early detection of fungal infections during storage, transportation and shelf life can be useful in the management of postharvest decay and can contain fresh fruit loss and waste.

AIM OF THE STUDY

The aim of this study was to analyze the volatile profile of whole peaches at commercial maturity level to highlight variation of VOCs emitted by *M. fructicola*-infected peaches compared to non-inoculated (control) fruits. The highly discriminant volatile compounds were proposed as potential markers for the further development of smart packaging sensors for the early detection of fungal pathogen infection.

MATERIALS AND METHODS

- Peaches cv. 'Extreme486' were selected in an orchard of Marche region (Central-Eastern Italy) and harvested at commercial maturity. Healthy fruit were inoculated with isolate of *M. fructicola*. Inoculated peaches were introduced in glass jars within 4 days after inoculation for VOCs analysis. The severity of infection was evaluated by measuring the diameter length (cm) of spoiled tissue.
- The extraction of volatile compounds emitted by *M. fructicola*-infected and non-inoculated (control) peaches was performed using the HS-SPME-GC-MS

Fig. 1 - Peach inoculated with isolate of *M. fructicola* with visible sporulation (left) and peaches closed in glass jars for VOC's analysis (right)

RESULTS AND DISCUSSION

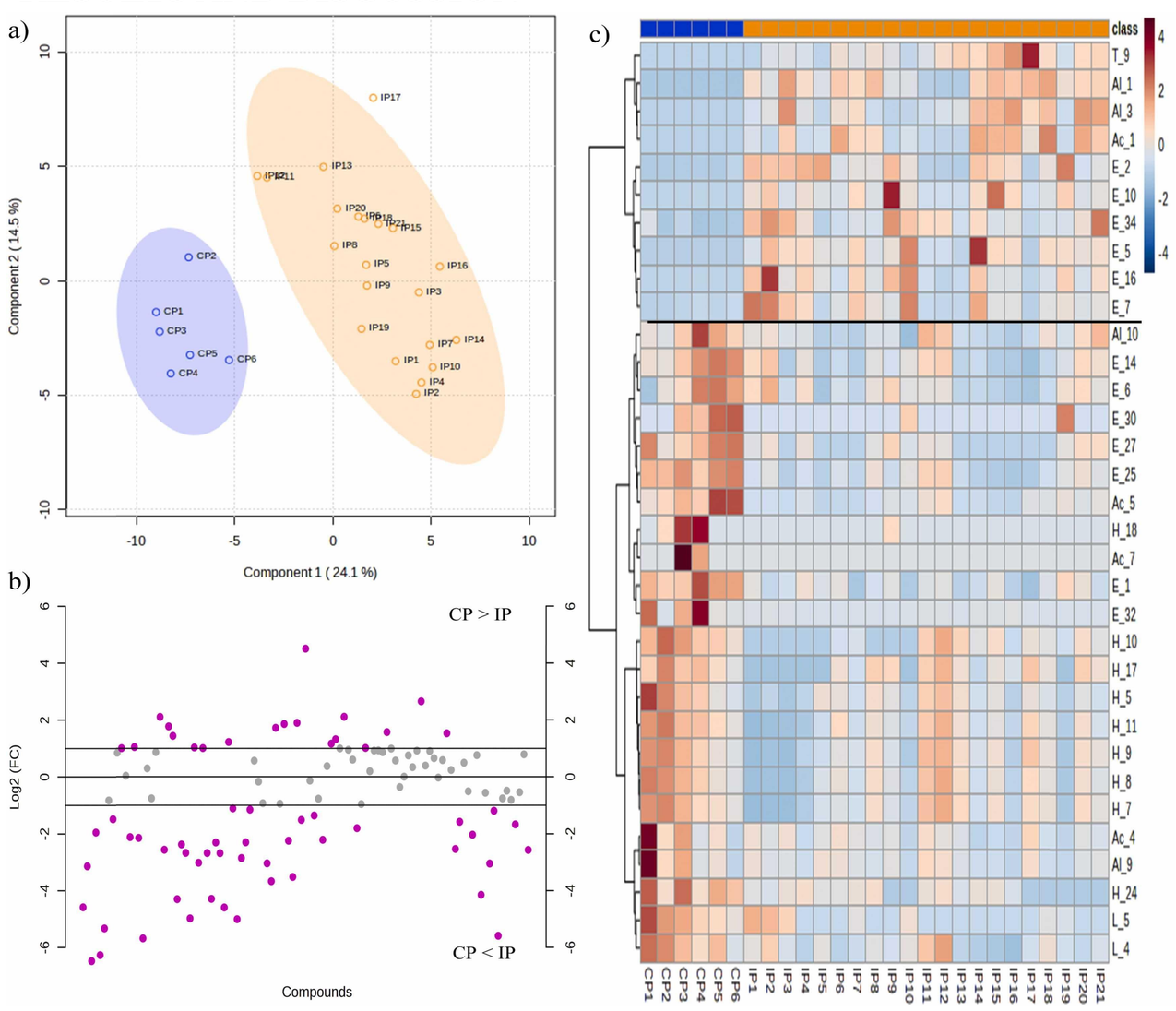

Fig. 2 - VOCs variation between control (CP, blue) and *M. fructicola*-infected (IP, orange) peaches. (a) Partial least squares-discriminant analysis (PLS-DA) of VOC profile of CP and IP. (b) Log2 fold change with threshold 2, positive values indicating predominant VOCs in CP, negative values indicating VOCs accumulated in IP. (c) Hierarchical clustering heatmap of all CP and IP samples, showing the 33 statistically different ($p < 0.05$) VOCs in the rows. Cell colors indicate the relative percentage of each VOC, blue representing low concentration and red high concentration.

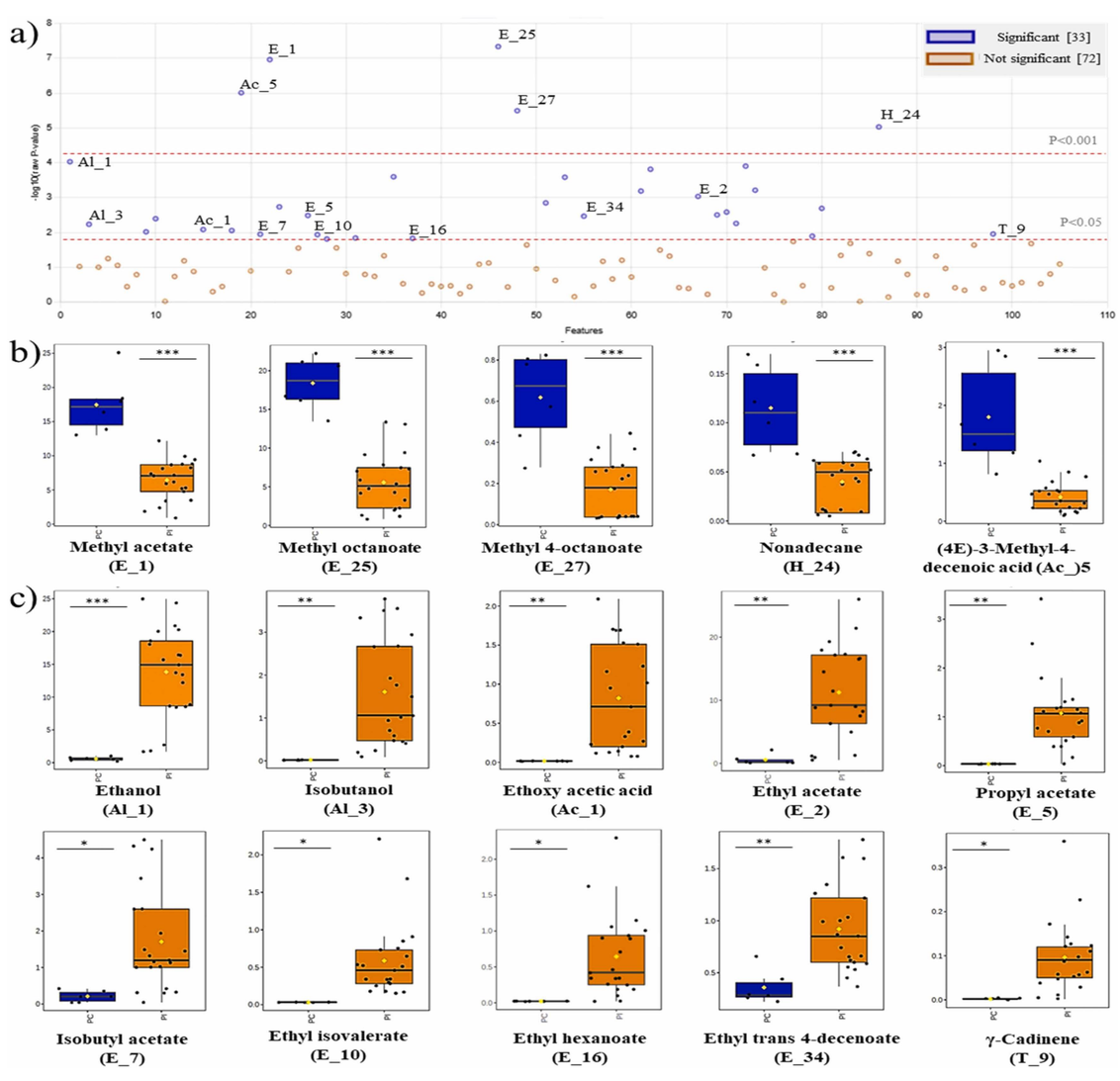

Fig. 3 - Variation of statistically different VOCs between control (CP, blue) and *M. fructicola*-infected (IP, orange) peaches. a) T-test corrected with False Discovery Rate (FDR), red lines showing statistically different compounds with p-values lower than 0.001 and 0.05. b) Box plots exhibiting the variation of the top 5 significantly different compounds. c) Box plots of the 10 discriminant compounds accumulated in infected peaches. Asterisks indicate statistically significant differences.

The aroma profile of control and M. *fructicola*-inoculated peaches was compared to identify discriminant VOCs. The level of methyl esters, hydrocarbons, lactones, and acids decreased in infected peaches indicating fruit aroma deterioration, while the concentration of ethyl esters and alcohols increased. In particular, the amount of ethanol and derived ethyl acetate reached a maximum of 24- and 20-fold increase in the infected peaches, respectively. Isobutanol, propyl acetate, and ethyl isovalerate were specifically emitted by *M. fructicola*-infected peaches. These compounds might serve as markers for the development of smart sensors allowing the detection of *M. fructicola* infection.

BIBLIOGRAPHY

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