

School of Biosciences

PhD Studentship (MIBTP-CASE)

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PhD project title: Epigenetic contribution to grafting induced vigour in Solanaceous plants

Supervisor: Dr Marco Catoni

Deadline for registration: 7th June 2020

Full description: https://warwick.ac.uk/fac/cross_fac/mibtp/pgstudy/icase

Eligibility: https://warwick.ac.uk/fac/cross_fac/mibtp/pgstudy/phd_opportunities/application/#Eligibility

Description: Grafting is a long-standing agronomical method used to improve plants production since more than 4000 years ago, consisting in physically joining two plants together, generally referred as rootstock (part below the ground) and scion (part above the ground). While grafting is traditional applied to trees, recently its use is becoming increasingly popular in commercial herbaceous crops, and Solanaceous plants in particular. This is because rootstocks can both provide resistance to several pathogens and increase plant vigour, improving plant production. While the processes providing pathogen resistance are well described and generally associated to intrinsic properties of the rootstock (e.g. natural immunity to pathogens in the ground), the enhanced plant vigour implies that indirect modifications of scion architecture are induced by the rootstock, and the underlined mechanisms are still largely unknown. Plant vigour has been associated to epigenetic modifications (Groszmann et al., 2013), and differentially methylated genes (epialleles) can affect phenotypes in plants with identical DNA genomic sequence (Dapp et al., 2015). In addition, experiments performed on model plants demonstrated that small RNA molecules (sRNAs) can move systemically from rootstock through the plant vascular tissue, and direct DNA methylation modification in scions (Melnyk et al., 2011; Wang et al., 2017).

In the proposed project, we aim to investigate the epigenetic contribution to grafting-induced vigour in tomato and eggplants, which are the most important herbaceous species commercially grafted in the Solanaceous family. Taking advantage of a collection of characterized commercial rootstocks developed by ENZA ZADEN, we aim to correlate the induced vigour with differences in the scion DNA methylation. This project will:

- Obtain the DNA methylation profile of tomato and eggplant scions grafted on different rootstocks, and investigate the differences in genome methylation associated to plant vigour.
- By using hetero-grafted plant combinations, screen and characterize rootstock-specific small RNA molecules travelling from the rootstock to the scion, potentially able to direct epigenetic changes.

- References:**
- Dapp, M., Reinders, J., Bédie, A., Balsera, C., Bucher, E., Theiler, G., Granier, C., and Paszkowski, J. (2015). Heterosis and inbreeding depression of epigenetic Arabidopsis hybrids. *Nat. Plants* 1, 15092.
- Groszmann, M., Greaves, I.K., Fujimoto, R., James Peacock, W., and Dennis, E.S. (2013). The role of epigenetics in hybrid vigour. *Trends Genet.* 29, 684–690.
- Melnyk, C.W., Molnar, A., Bassett, A., and Baulcombe, D.C. (2011). Mobile 24 nt Small RNAs Direct Transcriptional Gene Silencing in the Root Meristems of Arabidopsis thaliana. *Curr. Biol.* 21, 1678–1683.
- Wang, J., Jiang, L., and Wu, R. (2017). Plant grafting: how genetic exchange promotes vascular reconnection. *New Phytol.* 214, 56–65.

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Information: Interested candidate should contact m.catoni@bham.ac.uk