In vitro testing of plant extracts and essential oils as antimicrobials in organic farming

G. Grandi¹, C. Spadini², M. Iannarelli², M. De Marchi³, C.L. Manuelian³, R. Pitino², M. Simoni², C.S. Cabassi² and F. Righi²

¹Swedish University of Agricultural Sciences (SLU), Department of Biomedical Sciences and Veterinary Public Health, Ulls väg 26, 75756 Uppsala, Sweden, ²University of Parma, Department of Veterinary Science, Via del Taglio 10, 43126 Parma, Italy, ³University of Padova, Department of Agronomy, Food, Natural resources, Animals and Environment, Viale dell’Università 16, 35020 Legnaro, Italy; giulio.grandi@slu.se

The aim of the present work was to test in vitro the antiparasitic and antimicrobial activity of some selected plant extracts (PE) and essential oils (EO) to explore their possible use in organic farming. Three PEs (Malva sylvestris, Chamomilla recutita and Althaea officinalis) were assessed for their antiparasitic properties against gastrointestinal worms through a traditional microscopic detection method (larval development assay, LDA) using a laboratory strain of Haemonchus contortus as target organism. Moreover, the Minimal Inhibitory Concentration (MIC) assay was measured on 8 EO following the CLSI guidelines (CLSI, 2018b) protocol, with minor modifications, on 4 main bacterial strains (Escherichia coli ATCC 25922, Salmonella Typhimurium ATCC 14028, Staphylococcus aureus ATCC 25923 and MRSA ATCC 43300). All the tested PE demonstrated antiparasitic effect up to 20 mg/ml concentration, but a stronger activity of M. sylvestris and A. officinalis than C. recutita was observed, even at lower concentrations. The average EO’s MIC was 1.02% for E. coli, 1.5% for S. Typhimurium, 1.2% for S. aureus and 1.2% for MRSA. The lowest average MIC among all the tested strains was found for oregano oil (0.09%), followed by thyme oil (0.19%), tea tree oil (0.29%) and rosemary oil (0.8%). The highest average MIC were found for Lavender oil and Clove oil (2.57% each) followed by cinnamon oil (2.4%) and mentha oil (1.75%). Some of the tested PE and EO appear as viable alternatives to antimicrobials in organic farming based on the in vitro anthelmintic and antibacterial activity we observed. The setup of in vivo administration protocols (i.e. dosage, frequency of treatment) and the evaluation of potential side-effects deserve further studies. This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 774340.