and storability of lettuce grown in a hydroponic system, as compared to untreated control. Lettuce plants treated with the MLEs showed significantly improved quality parameters (leaf number, area, and color), total phenolic content and antioxidant activity, and resistance against the fungal pathogen *Botrytis cinerea*, comparable to that obtained with commercial formulates, particularly those based on the protein hydrolysate. A difference between the *M. oleifera* extracts was observed, probably due to the different compositions. Although further large-scale trials are needed, the tested MLEs seem a promising safe and effective preharvest means to improve lettuce agronomic and quality parameters and decrease susceptibility to rots.

Testing the efficacy of the Sanodyna® product for the control of *Gnomoniopsis castaneae*

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Gnomoniopsis castaneae (syn. *Gnomoniopsis smitholgivyi*) is an emerging fungal disease causing nut rot of sweet chestnut (*Castanea sativa*), currently affecting chestnut fruits production in several Italian regions. There is a lack of effective management and control strategies against this fungus due to the little knowledge about its epidemiology and its endophytic lifestyle. To date, post-harvest treatments, like the "curatura", which consists of submerging the fruits in hot water (50 °C) for 45-50 min and cooling them in a water bath at 15-18 °C for an equal time, are the only methods applied to control and manage the disease, also because in pre-harvest, i.e., in the chestnut groves, the application of fungicides is strictly limited by law. This study aimed at testing the efficacy of Sanodyna®, an environmentally-friendly product commercially sold as a sanitizer, to control *G. castaneae* in post-harvest treatments. Three concentrations, minimum (15 ppm), medium (110 ppm) and maximum (520 ppm), were tested for their ability to inhibit *G. castaneae*. The test was first carried out *in vitro*, by using different strains of *G. castaneae* and adding Sanodyna® into the culture-media. Then, the product was tested on chestnut nuts. A reduction in growth was observed *in vitro* compared to the control, but the treatment did not eradicate the disease from chestnut fruits. Indeed, the product was effective in sanitizing the external surface of the fruit, without being able to reduce significantly the frequency of the fungus. Results obtained in this work are a preliminary step towards implementing a control method against *G. castaneae* using Sanodyna®.

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Development of a new LAMP assay for the fast diagnosis of *Elsinoë fawcettii*

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The ascomycete fungus *Elsinoë fawcettii* Bitancourt and Jenkins (Myrianginoeaceae, Elsinoaceae) is a quarantined organism in the EU as it can cause important diseases (citrus scab, sour orange rind and common rind) on *Citrus* species, cultivars and hybrids. As the disease is still restricted to Georgia in the EPPO region, the possibility to rely on accurate and solid diagnostic protocols to unequivocally identify *E. fawcettii*, even at its latent stage, would be of great importance in order to prevent its possible introduction in uncontaminated areas and to control its impact. Traditional diagnosis of this fungus can be troublesome and time consuming, requiring well-furnished laboratories and expert operators with skills in mycology. DNA-based detection could therefore enable to overcome these drawbacks and allow a rapid, sensitive and accurate diagnosis of the pathogen. Recently, PCR and qPCR-based assays have been developed, able to simultaneously detect different pathogens affecting *Citrus* species, including *E. fawcettii*. To further

improve detection efficiency, in this work a species-specific assay based on Loop mediated isothermal AMPlification (LAMP) reaction was developed. Results proved the high specificity of the protocol, able to detect as low as 1.00 pg/µL of pathogen DNA in less than 30 minutes. The accuracy of the assay and its compatibility with a user-friendly, portable LAMP device, make this real-time monitoring method a tool of choice for routine phytosanitary control of plant material, which could profitably assist in the diagnosis, surveillance and control of *E. fawcettii*.

Stem and root rot of *Cycas revoluta*, a new disease caused by *Phytophthora pseudocryptogea*, and first report of *P. nicotianae* and *P. multivora* on *C. revoluta* worldwide

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Stunting, leaf yellowing and blight, root and basal stem rot were observed in pot-grown 3-year-old sago palm (*Cycas revoluta*) plants in commercial nurseries of ornamentals in Eastern Sicily (Italy). The objective of this study was to investigate the disease etiology. Three *Phytophthora* species (*P. multivora*, *P. nicotianae*, and *P. pseudocryptogea*) were recovered from rhizosphere soil of symptomatic plants, using leaf baiting and a selective medium. However, *P. pseudocryptogea* was the sole species isolated directly from rotten roots and stems. The isolates were identified based on both morphological features and phylogenetic analysis of multiple DNA regions (ITS, β-tub, and COI). The pathogenicity of the three *Phytophthora* species was assessed on potted one-year-old plants using both stem inoculation by wounding and root inoculation through infested soil. *Phytophthora nicotianae* and *P. pseudocryptogea* reproduced all the symptoms shown by plants with natural infections, but the latter was more virulent. Conversely, *P. multivora* induced only mild symptoms of root rot. *Phytophthora pseudocryptogea* was identified as the pathogen responsible for the new disease observed in Sicilian nurseries, as it was reisolated from artificially inoculated plants, thus fulfilling Koch's postulates. It is the first report of these three *Phytophthora* species associated with *C. revoluta* worldwide.

Into the deep of biological control agents against main grapevine diseases: results of quantitative and network meta-analysis

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The Farm to Fork and Biodiversity Strategies have recently set new goals for the reduction of pesticide usage and substitution of more hazardous active substances. Among alternatives, biological control agents (BCAs) are widely considered thanks to their low impact on human health and the environment. However, studies to evaluate the effectiveness of BCAs in suppressing plant pathogens often report inconsistent results. This research aims to provide a comprehensive overview of the performed studies and achievements for the biocontrol of major grapevine fungal diseases. In particular, a systematic literature review was conducted to summarize the studies on BCAs against downy and powdery mildews, black and sour rots, gray and black molds, and grapevine trunk diseases. The quantitative synthesis of published information showed a positive trend in the number of studies on biocontrol since the '90s. Overall, the most investigated genera were Bacillus, Pseudomonas, and Trichoderma. BCA efficacy depended on BCA-pathogen interactions, and the experimental conditions, with greater variability observed in field. To deepen our knowledge on BCAs efficacies under field conditions, network meta-analyses were applied to collected data on powdery mildew and grapevine trunk diseases. Black mold was also used as meta-analysis case study to provide new insights on the biocontrol of grape ochratoxigenic fungi.

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