The invasive seaweed *Rugulopteryx okamurae*: an innovative plant protective extract

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Abstract (250 words)

Grapevine downy mildew, caused by *Plasmopara viticola*, is a devastating disease worldwide. Most commercially important cultivars of the European grapevine are highly susceptible and therefore require the recurrent application of synthetic fungicides to control the disease, copper being the most frequently used. However, with European Union goals to lower their usage, there is a need to develop innovative and sustainable strategies. In this respect, seaweeds have proven to have great potential as phytosanitary agents, in addition to promoting plant growth and stress-tolerance.

A greenhouse experiment was conducted to determine the effectiveness of an extract of the invasive *Rugulopteryx okamurae* (RO) as resistance inducer and fungicide against *P. viticola*. The molecular and metabolic responses of two Tempranillo clones (VN40, RJ43), together with the changes on plant physiology and soil microbiota were investigated after seaweed applications and post-pathogen inoculation.

The extract preferentially induced Jasmonic acid (JA) related genes while inhibiting Salicylic acid (SA) responsive ones. In addition, in RO treated RJ43 plants SA pathway repression became stronger under *P. viticola* stress, and the antagonist relation between JA/SA pathways was corroborated. The later plants accumulated more piceid and had an increased activity of antioxidant enzymes. Moreover, RO slightly modified soil properties and soil fungal composition, the

nematophagous biological control agent *Harposporium* being particularly high at seaweed treated RJ soils. Importantly, disease severity was reduced in RO treated plants indicating its ability to promote grapevine protection. All results suggest Ruguloperyx extract´s potential as palliative against *P. viticola*.

Keywords: *Plasmopara viticola, Rugulopteryx okamurae*, biostimulator, fungicide, microbiota