

**UNIVERSIDAD DE LA FRONTERA**

Facultad de Ingeniería y Ciencias

Doctorado en Ciencias de Recursos Naturales



**REMOVAL OF PESTICIDES IN A CONTINUOUS PACKED-BED REACTOR PACKED WITH AN ORGANIC MATRIX INOCULATED WITH AN IMMOBILIZED CONSORTIUM OF BACTERIA AND FUNGI**

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**DOCTORAL THESIS IN FULFILLMENT OF  
THE REQUIREMENTS FOR THE DEGREE  
DOCTOR OF SCIENCES IN NATURAL  
RESOURCES**

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**2022**

**“Removal of pesticides in a continuous packed-bed reactor packed with an organic matrix inoculated with an immobilized consortium of bacteria and fungi”**

Esta tesis fue realizada bajo la supervisión del director de tesis, Dra. María Cristina Diez del Departamento de Agroindustria de la Universidad de la Frontera y ha sido aprobada por los miembros de la comisión examinadora.

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## **Thesis summary**

Red clover is a perennial legume with high nutritional value. Red clover declines up the second year of establishment because the attack of *Hylastinus obscurus*. Due to there is no chemical or biological control for this insect, in recent years it has been investigated the chemical ecology involve in the interaction *H. obscurus*-red clover. To date, some secondary metabolites produced by red clover with attractive, repellent and anti-feeding properties have been identified, highlighting the emission of the terpene limonene that has repellent properties towards *H. obscurus*. The ability of plant to produce a large number of terpenoids is supported by the presence of a large number of genes involved in terpene biosynthesis as an outcome of coevolution with natural enemies. Terpenoid defense compounds is prevented to increase in number indefinitely due to excessive cost or the evolution of a non-terpenoid-based defense pathways. Other terpenoids have non-defensive functions, including signalling to mutualists, such as pollinators or symbionts. On the other hand, phosphorus (P) and arbuscular mycorrhiza fungi (AMF) have been pointed out as important factors to increase the content of terpenes in plants. However, the relationship AMF-P interperene production hasn't been investigated yet in red clover.