

Investigating the Use of Seaweed Extracts as Biopesticides

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Abstract : Biosecurity is emerging as one of the most important issues facing the agricultural and forestry community. This is as a result of increased invasion from new pests and diseases with the main protocol for dealing with these species being the use of synthetic pesticides. However, these chemicals have been shown to exhibit negative effects on the environment. Seaweeds represent a vast untapped resource of bio-molecules with a broad range of biological activities including pesticidal. This project investigated both the antifungal and antibacterial activity of seaweed species against two problematic root rot fungi, *Armillaria mellea* and *Heterobasidion annosum* and ten quarantine bacterial plant pathogens including *Xanthomonas arboricola*, *Xanthomonas fragariae*, and *Erwinia amylovora*. Four seaweed species were harvested from the South-East coast of Ireland including brown, red and green varieties. The powdered seaweeds were extracted using four different solvents by liquid extraction. The poisoned food technique was employed to establish the antifungal efficacy, and the standard disc diffusion assay was used to assess the antibacterial properties of the seaweed extracts. It was found that extracts of the green seaweed exhibited antifungal activity against *H. annosum*, with approximately 50% inhibition compared to the negative control. The protectant activities of the active extracts were evaluated on disks of *Picea sitchensis*, a plant species sensitive to infection from *H. annosum* and compared to the standard chemical control product urea. The crude extracts exhibited very similar activity to the 10% and 20% w/v concentrations of urea, demonstrating the ability of seaweed extracts to compete with commercially available products. Antibacterial activity was exhibited by a number of seaweed extracts with the red seaweed illustrating the strongest activity, with a zone of inhibition of 15.83 ± 0.41 mm exhibited against *X. arboricola* whilst the positive control (10 µg/disk of chloramphenicol) had a zone of 26.5 ± 0.71 mm. These results highlight the potential application of seaweed extracts in the forestry and agricultural industries for use as biopesticides. Further work is now required to identify the bioactive molecules that are responsible for this antifungal and antibacterial activity in the seaweed extracts, including toxicity studies to ensure the extracts are non-toxic to plants and humans.

Keywords : antibacterial, antifungal, biopesticides, seaweeds

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