BoxProtect: Identification of 2-Methoxy-1,4-Naphthoquinone From I. glandulifera and Exploration of Its Potential in Insect Pest Control

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Himalayan Balsam (Impatiens glandulifera R.) is an invasive neophyte. I noticed that the leaves of Himalayan Balsam were spotless, while insects had massively damaged the neighboring vegetation. I concluded that Himalayan Balsam leaves contain pest-repellant substance(s). Therefore, I extracted leaves using a spectrum of solvents with different polarity, including water, methanol, ethanol, dichlormethan or pentan. Upon rotation evaporation, the solvent-free leave ingredients were used to treat insect food plants, while a second batch was treated with control solution. Treated and control food plants were offered simultaneously in a feeding arena, and the behavior of insect larvae was monitored. Leave ingredients extracted by methanol showed a prominent repellent effect towards box tree caterpillar and mealworms, while water and pentan extracted leave ingredients did not prevent larvae from feeding. To further narrow down active ingredients, I performed fractionation with diethylether and water followed by chromatographical separation. In samples with insect repellent activity, I could identify by mass spectrometry the known plant secondary metabolite 2-methoxy-1,4-naphtoquinone (2MNQ), which was not present in inactive fractions. Since the physico-chemical properties of 2MNQ matched the profile of the insect-repellent ingredient with regard to solubility and stability, this natural compound was the prime candidate for further investigation. Therefore, I employed synthetic 2MNQ in feeding experiments and observed that it was highly effective in repelling insect larvae from their preferred food items. Accordingly, 2MNQ is one of the pest repelling substance(s) in the leaves of Himalayan Balsam and could be used in the future as an organic plant protection.

Awards Won:
Fourth Award of $500