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DIVERSIFICATION OF PYRROLIZIDINE ALKALOIDS AS PLANT DEFENCE COMPOUNDS AND THEIR EFFECT ON *Spodoptera exigua* CELL LINES

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ABSTRACT

Pyrrolizidine alkaloids (PAs) are part of the constitutive chemical defence against herbivores. PA composition in plants is strongly determined by the environment, mostly in an unpredictable way. In this study the ability of different *Jacobaea* tissue cultures types including shoot, root and complete plants to produce and diversify PAs was evaluated. *Jacobaea vulgaris*, *Jacobaea aquatica* and three hybrids of a cross were used representing different genotypes. The cultures were harvested after nine weeks and PA content was measured using LC-MS/MS. We observed that not only roots, as known so far, but also shoots were able to synthesise *de-novo* PAs. Significant differences in total concentration of PAs were observed with the lowest concentration in the roots, followed by shoots and the highest concentration in complete plants. Evaluation of PA composition showed that senecionine- and otosenine-like PAs were present in both roots and shoots while next to senecionine-like PAs, jacobine- and erucifoline-like PAs occurred in the shoots and complete plants. Among these PAs, jacobine and erucifoline are the most effective against insect herbivores as indicated by correlative studies. In this way, the above-ground plants that suffer from herbivore attack are better defended. To test this, the two PAs and other commercially available senecionine-like PAs including, senecionine, seneciphylline, retrorsine, and senkirkine were tested as free base and *N*-oxide forms. A range of concentrations from 0 70 ppm was added to *Spodoptera exigua* cell line. The result showed jacobine and erucifoline appeared to be the most toxic PAs proving their major role in plant defence against generalist herbivores. Senkirkine and seneciphylline showed a lower toxicity than jacobine and erucifoline but higher than retrorsine. Senecionine was not toxic at the tested concentrations. In all toxic PAs the free base form was more toxic than the *N*-oxide form. The results obtained give us an insight in what plant organs PAs are produced and how there are distributed over different plant organs, that have great relevance to understand their role in plant defense.

Keywords: *Jacobaea*, *Spodoptera exigua*, pyrrolizidine alkaloids, diversification, toxicity.

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