

Pyrrolizidine alkaloid level in *Senecio jacobaea* and *Senecio erraticus* - the effect of plant organ and forage conservation

Introduction

Senecio jacobaea L. and also *Senecio erraticus* Bert. increasingly occur on pastures and meadows of North Rhine-Westphalia. Although it is well known that they contain toxic pyrrolizidine alkaloids (PAs) there are no results concerning the amount of PAs under the growing conditions of North Rhine-Westphalia and only few trials are reported regarding the stability of PAs in hay and silage. Our trials involve these aspects.

Materials and methods

Plant material of *Senecio jacobaea* and *Senecio erraticus* was collected in 2008 in different maturity stages, separated according to plant organs (leaves, stems, flowers, complete plants) and immediately dried in a drying cabinet (60 °C) to prevent any decomposition of the PAs. Additionally, material of the complete plants was dried for hay under field conditions and also prepared for ensiling in preserving glass jars. All different samples (3 repetitions each) were analysed for PAs by gaschromatography-massspectroscopy (Wiedenfeld et al., 1981).

Results

1. Differences in the patterns of PA composition of *Senecio jacobaea* and *Senecio erraticus*.

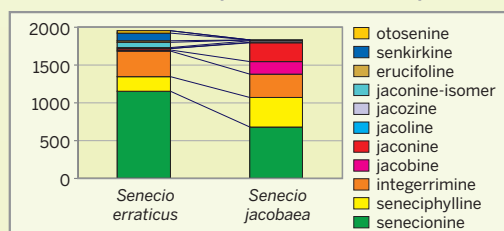


Figure 1: Dry matter content ($\mu\text{g g}^{-1}$) of PAs in the complete plants of *S. erraticus* and *S. jacobaea* at full flowering.

Ten PAs were identified in the plant material. The PAs senecionine, seneciphylline and integerrimine were the major compounds in both species. Jacobine, jaconine, jacozine, jacoline were especially found in *S. jacobaea* whereas erucifoline, senkirkine, otosenine were only found in *S. erraticus*.



2. Change and amount of PAs in the different parts of *Senecio jacobaea* during maturity.

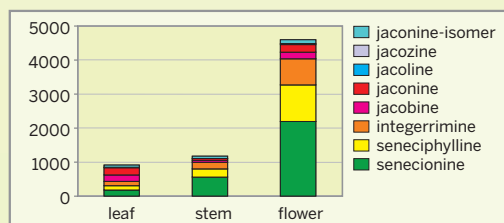


Figure 2: Dry matter content ($\mu\text{g g}^{-1}$) of PAs in the different plant organs of *S. jacobaea*.

Analysis of the separate plant organs confirmed that PA concentration is highest in blossoms, but the concentration of $4607 \mu\text{g g}^{-1}$ in DM in blossoms was extremely high which caused the strong increase of PA concentration up to $2057 \mu\text{g g}^{-1}$ in DM in the whole plant in flowering stage.



3. Stability of PAs of *Senecio jacobaea* in hay and silage

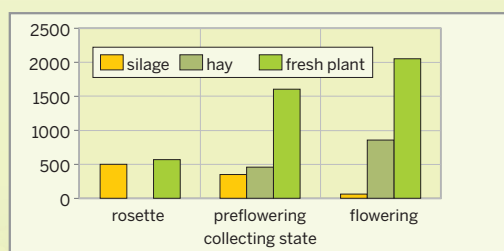


Figure 3: Total PAs dry matter content ($\mu\text{g g}^{-1}$) in complete plants, hay and silage of *S. jacobaea*.

The decrease of the PA level in hay appeared to be up to 40 %, which indicates that there was no general decomposition of PAs by hay production. As hay is generally produced in later stages of maturity, where highest concentration of PAs can be found, there is a serious risk of intoxication by hay containing *S. jacobaea*. There was a remarkable decrease of the PAs in silage. The level of decomposition in silage increased during the vegetation period which can be explained by the higher enzymatic activity in plants from this stage compared to that in young plants. As PAs are hydrolysed by unspecific esterases which results in non-toxic necines and necic acids, it can be assumed that during silage production an enzymatic decomposition of the alkaloids takes place. Although these results could encourage the conclusion that ensiling helps reducing the risk of poisoning by PAs, the minor effect in the early stage of plant development demands further examination to answer the question, by what circumstances PAs will be reliably destroyed.



Conclusions

- The two *Senecio* species showed similar amounts of overall concentration of PAs although they differed in the patterns of PA composition.
- The risk of intoxication is mainly due to the later stage of development as the PA content was especially high in the blossom and thus in the elder plants.
- The concentration of PAs in the plants decreased during forage conservation, especially by ensiling in later stages of maturity, but the results indicated an interaction between plant age, PA concentration and PA stability.
- It is concluded that ensiling cannot be recommended as a reliable method to eliminate the risk of intoxication by feeding silage containing *Senecio jacobaea* and *Senecio erraticus*. Also the decline of PAs by drying for hay is insufficient to use hay from these plants as forage.

References

- Wiedenfeld H., Pastewka U., Stengl P. and Röder E. (1981)
 On the gas-chromatographical determination of the pyrrolizidine alkaloids of some *Senecio* species.
Planta medica 41, 124-128.