Detection of pyrrolizidine alkaloids related plants in Feed by NIR Hyperspectral Imaging

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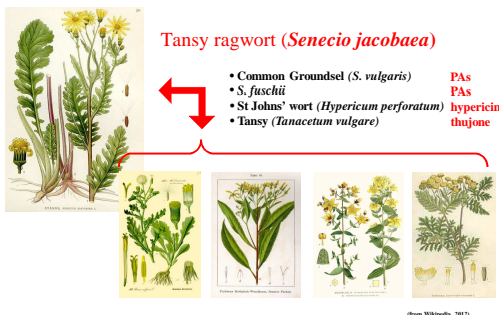*Corresponding author: v.baeten@cra.wallonie.be*

Introduction

Pyrrolizidine alkaloids (PAs) are toxins found naturally in a wide variety of plant species that affect wildlife, livestock and humans. Poisoning caused by these toxins is associated with acute and chronic liver damage and may be fatal. The detection of PAs in food and feed remains an important challenge and there is a real need for rapid, accurate, non-invasive and non-destructive methods as alternative to the MS-based methods used now. The study presented here concerns the detection of several toxic species in hay using NIR Hyperspectral Imaging combined with chemometric methods.
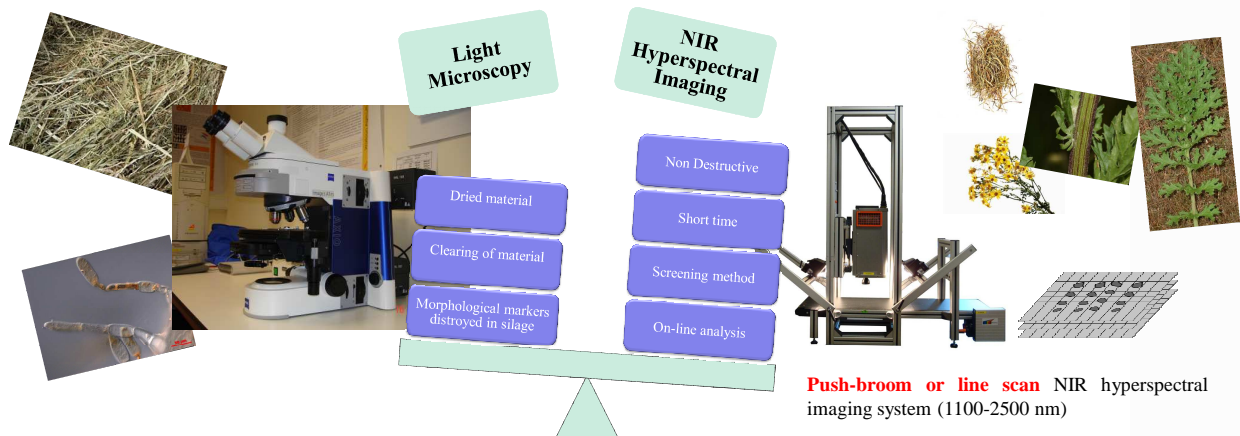
The problematic

A complete analytical survey should focus on selected alkaloids, which have been identified as major toxic compounds, while at the same time being representative for major PAs-containing plant families. In this work we focus on one of the most important group of toxic plants, the *Senecio* taxon, which is one of the most important alkaloids containing plant group that has been associated with clinical intoxications in livestock.

Tansy ragwort (*Senecio jacobaea*)

- **Common Groundsel** (*S. vulgaris*) — PAs
- *S. fuschii* — PAs
- **St Johns' wort** (*Hypericum perforatum*) — hypericin
- **Tansy** (*Tanacetum vulgare*) — thujone

(from Wikipedia, 2012)

Senecio sp. has been found not only in flour, indicating contamination with weed species containing alkaloids but, because the PAs can be distributed differently in the plant, some parts of *S. vulgaris* plants were recently detected in packed salads. For this reason, in this work a NIR Hyperspectral Imaging system is proposed as a rapid, non-destructive and non-targeted technique dealing with samples from different size level, from the flour to the whole plant allowing detecting different plant organs of PAs-containing species in hay.
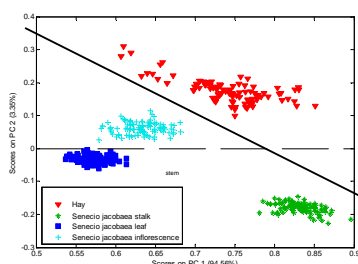
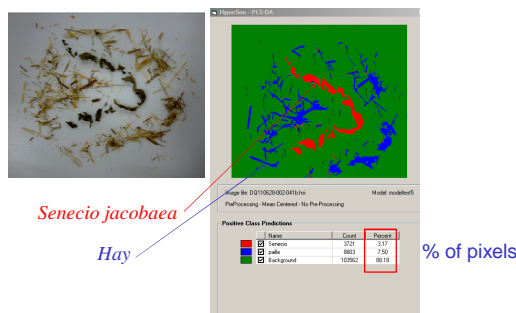**Reference method: Light Microscopy ~ Alternative method: NIR Hyperspectral Imaging**

Light Microscopy
- Dried material
- Clearing of material
- Morphological markers distroyed in silage

NIR Hyperspectral Imaging
- Non Destructive
- Short time
- Screening method
- On-line analysis

Push-broom or line scan NIR hyperspectral imaging system (1100-2500 nm)

Some preliminary results

S. jacobaea vs Hay

Principal Component Analysis (PCA)

- Hay
- Senecio jacobaea stalk
- Senecio jacobaea leaf
- Senecio jacobaea inflorescence

Discriminant equation (PLS-DA model)

Senecio jacobaea
Hay
% of pixels

Application of method to other species ? YES

exemple : H. perforatum vs Hay

Principal Component Analysis (PCA)

Hyp. leaf
Hyp. stem
Hay
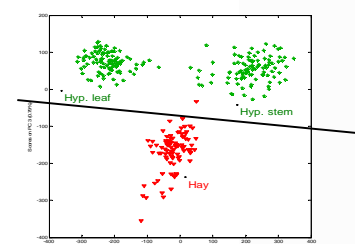
Conclusions

This preliminary study has shown that NIR hyperspectral imaging can allow a non-destructive and automatic species detection (time, large samples), which is independent from morphological markers. The results indicate that spectra coming from a NIR hyperspectral imaging system show different according to organs, probably due to the chemical accumulation of PAs and other secondary plant metabolites.

References

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