

Identification tools as part of Feedsafety research: the case of ragwort

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Abstract — Ragwort (*Senecio jacobaea*) and related species of the genus *Senecio* are the main source of pyrrolizidine alkaloids. These plants grow in road verges, meadows and production fields and they show up in parties of roughage: grass and alfalfa. Monitoring can be carried out during the field production and harvesting stages. The final objective is to reject parties with a too high contamination level. Identification tools can support the decision to accept or refuse materials for the food production chain. A ragwort model has been developed for the mobile application Determinator. This identification model includes the relevant objects (species of the genus *Senecio*), and a range of so called confusing objects in order to minimise the chance of false positive identifications.

Index Terms — Determinator, diagnosis, identification, ragwort.



1 INTRODUCTION

Safe feed is one of the cornerstones of a healthy food production chain, and as important side-effect it supports the desired welfare of husbandry animals. In a lot of cases in the history of feed and food production emerging risks were initially detected by visual surveillance. Also in a majority of those cases visual inspection was replaced by more dedicated chemical detection methods.

Nevertheless, new risks still emerge and visual inspection is still at hand at the same moment that surveillance is needed. Recent examples are *Ambrosia* seeds in bird feeds, packaging materials in overdue materials, precatory bean (*Abrus precatorius*, in 2009 included in legislation) and ragwort in roughage and in salads for human consumption. The well known problem of animal byproducts is still primarily based on visual control. Identification tools are an essential support for these diagnosing problems.

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2 THE RAGWORT PROBLEM

2.1 BACKGROUND

Ragwort (*Senecio jacobaea*) is one of the sources of pyrrolizidine alkaloids and it can occur in parties of roughage: grass and alfalfa. Pyrrolizidine alkaloids are toxic for animals and a long term lethal effect is observed, especially in horses. Many other species of *Senecio* (e.g. common groundsel, *S. vulgaris*) and species of the family Boraginaceae (*Symphytum*, *Echium*) will produce pyrrolizidine alkaloids as well [1], [2].

Monitoring of the ragwort / pyrrolizidine alkaloids problem can be effected at several stages in the feed production chain. Visual inspection can be carried out during the field production and harvesting stages, when fresh materials are still present. Chemical LC-MS/MS analysis can be applied to trade parties of dried and processed roughage. In any situation visual screening can be followed by chemical confirmation.



Fig. 1 – Inflorescence of ragwort, *Senecio jacobaea*.

2.2 STRATEGY

Monitoring of production fields or road sides where *Senecio* species might occur is effective during pre-harvesting and harvesting times. On the spot identification and qualitative risk assessment can be achieved with a mobile knowledge system. Based on the prevalence of ragwort or other species it can be decided to use a harvested party for feed production or to ignore and destroy contaminated parties. In this way, identification tools can be useful for early

warning systems, so that costs in subsequent parts of the production chain can be avoided.

2.3 KNOWLEDGE SYSTEM DETERMINATOR

Support of monitoring in those pre-harvesting stages is provided by the knowledge system Determinator. A datamodel is developed for this knowledge system including five *Senecio* species, and a series of 22 different yellow-flowering species, which can be confused with ragwort. Determinator can be used in laboratory (Windows XP, Vista) as well as in field situations (Windows mobile).

Determinator is a program package that assists the user in “determining” or identifying an object. A final conclusion is reached by entering answers to questions associated to the objects included in the dataset used. A match is calculated between the object as described by the user and each of the targets included in the chosen dataset. The process of identifying an object is supported by the possibilities to browse the included targets, and to compare two targets in every combination.

Every target in a fully developed datamodel is available with a description, with one or more images, and with one or more states for every feature (character). The descriptions and images are used to document the targets after the option Browse. The lists of feature states are being used to Compare two targets, and to Identify an object chosen by the user.

Determinator and the ragwort datamodel are freely available: www.determinator.wur.nl/UK/. Some screenshots are shown in Fig. 2.



Fig. 2 – Screenshots of Determinator on a Windows mobile-based smartphone.

3 DISCUSSION

The ragwort datamodel developed for Determinator is a highly dedicated identification tool. It is an example of an open classification model: only diversity is included that can directly support the final decision. Open classification models can function only in a situation where closed classification systems exist that

included all the existing diversity [3], [4], [5]. The flora of the Netherlands and the flora of the British Isles in Linnaeus II [6] are examples of such classification systems that support the selected diversity in the ragwort datamodel. Another example of an open classification model is the decision support system ARIES [7] designed to support the ban on animal by-products as feeding stuff.

The philosophy of the ragwort datamodel and of ARIES is to include two types of objects. The first type of objects includes the species of *Senecio* or all types of animal by-products, respectively. The second type of objects added to the datamodel consists of a range of confusing objects. These confusing objects are meant to minimise false positive identifications.

Open classification models provide a good support for certain types of risk assessments, where information on identification is necessary. They can be developed in a relatively short time, exclusively targeted information should be included, and a connection exists with closed classification systems providing a full view on the relevant diversity.

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