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Scientific sniffers: Dogs help to identify toxic plants in animal feed.**Ragwort (*Senecio vernalis*) in hay poses a health risk to livestock**

Their names are Leo, Siri, Suri, Käthe, Hilde and Barni, and they have just started helping out at the German Federal Institute for Risk Assessment (BfR). The dogs are supposed to make feed safer. To do this, they were trained to sniff out toxic plants in hay, such as spring ragwort.

This plant naturally produces pyrrolizidine alkaloids (PA) – secondary plant compounds, some of which can damage the liver and cause cancer. If the plants end up in hay or silage, they can cause fatal poisoning, especially in cattle and horses. In small amounts, the toxins can also transfer into animal-based foods and reach the human body.

Initial results from the research project show that the dogs are able to reliably distinguish spring ragwort from other plants by its smell. They can also detect hay samples that contain only small amounts of spring ragwort. In the next and final step the dogs are asked to identify the toxic contamination in hay bales under real conditions.

In the future, specially trained dogs could help horse owners, for example, to check feed hay for contamination or enable appropriate risk-oriented sampling.

Ragwort and eastern groundsel belong to a species-rich genus of plants found all over the world. When it comes to possible contamination of feed, Eastern groundsel and ragwort (also known as spring ragwort and St. John's crosswort) are particularly significant. Both species produce PA as a defence against herbivores – and with success: horses and cattle usually avoid these bitter-tasting plants when grazing in pastures. However, if they end up in hay or silage, the animals ingest the plants along with the undesirable substances they contain. Even in relatively small amounts, these substances can cause liver damage and, in the worst case, lead to the death of the animals if larger amounts are ingested. To date, there are no simple methods for reliably detecting such impurities in hay.

This is where the animal research assistants come in: the four Labrador Retrievers and two Australian Shepherds, who with their owners are intensively engaged in scent detection work, were challenged with proving in specially designed experiments that they can identify unwanted plants, specifically eastern groundsel (*Senecio vernalis*). Dr Carola Fischer-Tenhagen's team first trained the dogs to recognise the plant's characteristic scent. In an initial series of experiments, the experimenter placed a sample among a total of 12 plant samples, including dandelion, field mustard and buttercup in a line-up setting. The experiment was double-blind, meaning that neither the dog handler nor the scientist conducting the experiment knew which container contained the eastern groundsel sample. This prevented unintentional signals from humans leading the dogs to the correct trail. The dogs sniffed a total of 419 samples. The result: in all tests, the dogs found the samples containing eastern groundsel (sensitivity: 100 per cent). There were very few false positives, meaning that in most cases the dogs did not mistakenly identify other plants as ragwort (specificity: 88 per cent).

In a second series of tests, 3 grams of eastern groundsel were mixed into a bucket containing 400 grams of hay, and the dogs were then sent to search again. The six dogs worked through a total of 402 samples and achieved a very high hit rate in this experiment as well: sensitivity was 97 per cent and specificity was 98 per cent. The final phase of the experiment, which is expected to take place early next year, will be the practical test for the dogs. They will then have to detect small amounts of eastern groundsel in whole, pressed hay bales.

Severe poisoning after consuming plants containing PA occurs repeatedly in livestock. For example, cirrhosis of the liver has been detected in beef cattle that had ingested ragwort via hay and silage. PA can also enter the human organism via milk and other animal food products. Although there is currently no evidence that animal food products contain concentrations that would pose a health risk, the principle applies that the concentration of genotoxic carcinogens such as PA in food should be as low as technically possible.

Further information on pyrrolizidine alkaloids is available on the BfR website

Questions and Answers on Pyrrolizidine Alkaloids in Food

<https://www.bfr.bund.de/en/service/frequently-asked-questions/topic/questions-and-answers-on-pyrrolizidine-alkaloids-in-food/>

Topic page Health assessment of pyrrolizidine alkaloids

<https://www.bfr.bund.de/en/food-safety/assessment-of-substance-risks-in-foods/health-assessment-of-contaminants-in-food/health-risk-assessment-of-mycotoxins-and-plant-toxins-in-food/health-assessment-of-pyrrolizidine-alkaloids/>

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