Scientific Minipapers

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Tissues and Milk Residues of Tansy Ragwort Alkloids

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Introduction

There are more than 1,200 species of *senecio* in the world. Several of these species contain a varying number of pyrrolizidine alkaloids. Certain molecular configurations of these alkaloids are hepatotoxic and are considered carcinogenic by some pathologists. *Senecio jacobaea* (tansy ragwort), a plant that contains pyrrolizidine alkaloids has been responsible for death losses of cattle and horses in California, Oregon and Washington. It has been suggested that pyrrolizidine alkaloids might be transferred into the milk of lactating dairy cattle and lactating dairy goats consuming contaminated pasture, hay, or silage. In addition, there was concern expressed of a possible public health threat to the human population, primarily from contaminated milk but also from tissue of meat consumed for food. Because of this concern, certain studies were undertaken at Washington State University College of Veterinary Medicine in order to determine the validity of these particular concerns.

Research

Lactating cows and dairy goats were freshly prepared with rumen canulas. Air dried tansy ragwort was administered by the rumen canula to each animal at the dosage rate of one percent of the body weight per day. Various paramaters were monitored during the study with particular reference to weight gain or weight loss and milk production. In addition, blood leucocyte, plasma albumin, and serum sorbitol dehydrogenase levels were recorded. The latter is a rather specific enzyme for liver function, the liver being the primary target organ for the pyrrolizidine alkaloids.

The plant material was assayed for pyrrolizidine alkaloid content, and specific alkaloids were isolated from the plant material. Contrary to popular belief the first-year rosette of the plant contained no higher alkaloid concentrations than the second year growth of this biennial. There was a variation within the plant as far as content concerned with the flower or blossoms containing the highest concentration, 0.37%. The average content for the plant was 0.16% which was a rather constant figure over a two-year period.

A considerable decline in weight was observed in the dairy cows during the forty-day study period. At the end of approximately two weeks the milk production had dropped to a rather low level. At the same time, sorbitol dehydrogenase levels had risen enough to make a definite diagnosis of pyrrolizide alkaloid toxicity. There was a decline in the plasma albumin and an increase in blood leucocytes. None of these changes were observed in the calves which were receiving milk from the cows. In the case of the dairy goats, there was a slight significant increase in the sorbitol dehydrogenase levels; some eventual increase in blood leucocytes and a decline in plasma albumin occurred. However, the dairy goats maintained their weight reasonably well during the forty-day test period, and no observable changes could be detected in the kids that were drinking the milk from these lactating goats.

It was concluded that even in cows that were seriously afflicted with pyrrolizidine alkaloid toxicity, the effect on the calves drinking the milk was negligible. In the case of the goats, observable changes were not detected in either the does or the kids. However, pyrrolizidine alkaloids were isolated from the milk in both cases. The concentrations averaged 68.4 micrograms per 100 millimeters of milk in the cows and 38.1 micrograms per 100 millimeters of milk in the dairy goats. Apparently the concentrations were low enough that no measurable damage could be detected in the offspring.

A rather laborious assay was undertaken to determine the levels of pyrrolizidine alkaloid in the tissues. Great difficulty was encountered in securing any detectable levels. In most instances the values were below one part per billion. Exception to this were assays of the liver where levels could be recorded as significant. However, because of the difficulty in achieving the desired results a radioimmune assay is being

developed which will make possible the accurate detection of very, very small amounts.

Conclusions

On the basis of the research work completed, there would appear to be limited danger to the human population in the consumption of milk from dairy cows. In a well-run commercial dairy operation it is unlikely that tansy ragwort or other plants of this type would be consumed by animals receiving high-quality roughage. Since dairy goats are somewhat more resistant to the alkaloids, it would be possible for a significant concentration of these alkaloids to be passed on to the human population, particularly in view of the fact that goat dairies are often small in size and cater to a small number of customers. In theory, there could be a human public health hazard; however, the research work does not indicate that the alkaloids were damaging to the young animals receiving the milk and that conclusion could be extrapolated to the human population as well.

Of greater danger to the human population is the marketing of a number of herbal teas throughout the United States, particularly in Southwestern United States. Deaths have been reported from the consumption of these teas, and as long as there is no viable control on the sale of these products, that the threat remains to the human population. The concentrations consumed under these circumstances would be many times that possibly received from contaminated milk. Therefore, at the present time, conclusions are that there is little public health danger in the consumption of milk from either dairy goats or dairy cattle. As was noted above, the blossoms of plants contain high pyrrolizidine alkaloid content and contamination of honey has been well established by several workers. The danger to the human population from this product is yet to be assessed.

Tansy ragwort toxicity will continue to be a problem to cattle and horses in the Pacific Northwest. The losses are significant particularly with beef cattle and horses and will continue to be so until more stringent weed control measures are implemented. Field diagnosis continues to be a problem. The use of histopathologic examination plus serum levels of alkaline phosphatase and gamma glutamyl transpeptidase appear to be most efficient tools for confirmation of diagnosis. Use of only one enzyme assay or only histopathologic examination tends to leave areas of doubt as to actual cause of pathologic condition.

References

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Spaying of Western Range Heifers:

Dr. Jim Curtis, Malta, Montana

There is considerable controversy regarding the spaying of heifers, their efficiency, conversion, rate of gain and so forth. But let's review the positive side.

1) A spayed heifer will not breed.
2) The range man need not supply bulls for her
3) The feed lot man need not worry about calving her
4) Very importantly she is removed from the nation's cow herd as a number builder.

There has been much written and discussed about keeping heifers "open", their management and keeping bulls out and so forth but much of this criticism comes from the Midwest and I can assure you, it is a very different problem in the Midwest where you can run 50 or 100 yearlings on 40 to 50 acres and count them through the gate each night than it is in western range country where you run 300 to 400 yearlings on several *sections* of land, not acres, and no one can physically cover that much ground even in a few weeks and keep fences up, gates closed and cattle sorted.

Spayed heifers can be run with steers, breeding heifers or even stock cows without causing the least disturbance to the herd because of cycling. Bulls need not be provided for them and the cost of spaying is much less than the cost of breeding.

And again, the feeder need not worry about calving her when she reaches 900 or 1000 lbs. next spring when she is about finished. The feed conversion and gain ability is reportedly reduced in spayed heifers. But let me remind you, that you are never spaying your best heifers: the big growthy ones. It is always the tail enders, the poor ones that are selected for spaying.

A movie was made with several motives in mind:

1) To demonstrate a method of spaying large numbers of yearling heifers.
2) To demonstrate that large numbers of cattle can be worked in fairly simple corrals at a properly equipped veterinary clinic. Herd work need not necessarily be done in the country away from the clinic.
3) The movie was made after I realized that my efforts to achieve any fortune were futile and perhaps I should try for fame as a movie star instead.

One particular client has spayed 3 to 400 heifers at our clinic for the past three years. He moves them by truck from his wintering lot in the valley to the clinic some 20 miles away. The heifers are unloaded, spayed, immediately reloaded and delivered to his range land 20 miles farther on. We have never had a death loss, any illness, wound dehiscence or any problems whatsoever with this system. In the average spring we usually spay around 2000 head.

The Phillips County Veterinary Clinic, Malta, is situated in the eastern range country of Montana. It is a steel construction building, 35x60 ft. square, serving both large and small animals in a 6,000 sq. mile area. Of course for an