

Distribution of Glycoside Hydrolases and Polysaccharide Depolymerases Associated with the Particulate Fraction from the Bovine Rumen and an Artificial Rumen

A. G. WILLIAMS, I. M. MORRISON, N. H. STRACHAN,
AND R. E. BRICE

Hannah Research Institute, Ayr KA6 5HL, UK

ABSTRACT

The structural carbohydrates of plant cell walls are degraded and utilized in ruminants by the synergistic action of a number of species of organisms. Electron microscopy has shown that several different morphological groups of bacteria are attracted to the plant cell wall during the degradation process. Many of these bacteria, which act in close proximity to the cell wall, bind to the wall *via* their own extracellular polymeric adhesives.

In addition to the cell wall-associated organisms, two other subpopulations have been identified as those colonizing the free rumen fluid and those associated with the rumen epithelium (Cheng et al., 1979). Of the subpopulations acting on digesta, most work has been carried out on the nonassociated group, even though 50–70% of the rumen bacteria are associated with the feed particles. In this report, we show the distribution in activity of a wide variety of carbohydrate-degrading enzymes associated with the particulate fraction in both *in vivo* and *in vitro* systems.

The *in vivo* method employed was to suspend the cell wall material in nylon bags of fixed pore size in the rumen of a cow fed on a similar diet, while the *in vitro* system was the artificial rumen technique (Czerkawski and Breckenridge, 1977) using rumen liquor from a sheep fed on a similar diet. The digesta and the associated liquid phase were subjected to different fractionation procedures and the activities of a wide variety of glycoside hydrolases and polysaccharide depolymerases were determined using conventional techniques.

In general, the results from the *in vivo* and *in vitro* methods were in good agreement. Highest levels of activity for the various enzymes that are required

for cell wall degradation were found in the populations attached to or closely associated with the feed particles. Included in these enzymes were cellulases, hemicellulases, β -D-xylopyranosidase, and α -L-arabinofuranosidase. Separate functional groups of organisms could be recognized in the particle-associated population by their distinctive profiles. The activity of enzymes not associated with cell wall degradation (e.g., amylases and α -D-glucosidase) were low, although high levels were found in the free rumen fluid.

REFERENCES

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2. Czerkawski, J. W., and Breckenridge, G. (1977), *Br. J. Nutr.* **38**, 371.