RESEARCH

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Abstract: Anaerobic fungi (phylum Neocallimastigomycota) play a crucial role in degrading forages and fibrous foods in the gastrointestinal tract of mammalian herbivores, particularly ruminants. Currently, they are classified into twenty-two genera; however, recent research suggests the occurrence of several novel taxa that require further characterization. Anaerobic rumen fungi play a pivotal role in lignocellulose degradation due to their unique enzymatic capabilities. This review explores the enzymatic systems of rumen anaerobic fungi, highlighting their ability to produce a diverse array of carbohydrate-active enzymes (CAZymes), such as cellulases, hemicellulases, and pectinases. These enzymes facilitate the breakdown of complex plant polymers, making anaerobic fungi essential contributors to fiber degradation in the rumen ecosystem and valuable resources for biotechnological applications. This review summarizes the structural and functional diversity of fungal CAZymes, and the mechanical disruption of plant cell walls by fungal rhizoidal networks is discussed, showcasing the ability of fungi to enhance substrate accessibility and facilitate microbial colonization. Recent studies using genomic, transcriptomic, and biochemical approaches have uncovered several novel CAZymes in anaerobic fungi, including multifunctional xylanases, β-glucosidases, and esterases. These findings highlight the continued expansion of fungal enzyme repertoires and their potential for biotechnology and feed applications. Continued research in this field will enhance our understanding of microbial ecology and enzyme function, paving the way for applications that address global challenges in energy, food security, and environmental sustainability.