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ORIGINAL ARTICLE

Degradation of euptox A by tannase-producing rumen bacteria from migratory goats

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Abstract

Aims: The gut microbiota capable of degrading plant biomass and antinutritional phytometabolites are of immense importance. This study reports isolation and characterization of tannase-producing rumen bacteria that could also degrade euptox A (9-oxo-10,11-dehydroageraphorone) present in *Eupatorium adenophorum* (Spreng).

Methods and Results: Migratory *Gaddi* goats were selected as source of inoculums for isolating rumen bacteria with ability to produce tannase which catalyses degradation of hydrolysable tannins (HTs). Three rumen bacterial isolates producing tannase were studied, and identified as *Klebsiella variicola* strain PLP G-17 LC, *K. variicola* strain PLP S-18 and *Klebsiella pneumoniae* strain PLP G-17 SC. The isolates exhibited optimal tannase activity at 40°C, and pH 6·0. The bacteria could also degrade euptox A, a potent hepatotoxin in *E. adenophorum* Spreng, a widely distributed noxious weed.

Conclusions: The rumen bacteria could degrade antinutritional HTs and euptox A. Culture-independent metagenomic interventions are envisioned to completely decipher the rumen microbial ecology and exploit its genetic and metabolic potential.

Significance and Impact of the Study: The bacteria producing tannase which catalyses degradation of HTs, and concurrently degrading euptox A, may have potential as microbial feed additives to increase utilization of plant biomass containing antinutritional phytometabolites.

Introduction

Lack of quality forage is the major cause of decline in production potential of the livestock. The livestock in developing countries thrive primarily on crop residues, grasses infested with noxious weeds, plants and tree leaves that contain indigestible lignocellulose and various antinutritional phytometabolites such as tannins, saponins, alkaloids, oxalates, oestrogenic compounds and nonprotein amino acids (Bhat *et al.* 1998; O'Mara 2012; Singh *et al.* 2012).

The tannins are naturally occurring water-soluble polyphenolic compounds having molecular weight ranging from 0·5 to 3·0 kDa, and widely distributed in vascular plants including pteridophytes, and angiosperms used as food and feed. Ingested tannins exert various effects on biological systems including binding to proteins, gastric enzymes, cellulose, starch and minerals thereby forming complexes that are resistant to gastric and gastrointestinal (GI) microbial digestion. Based on their structure, the tannins are divided broadly into two categories: hydrolysable tannins (HTs) and condensed tannins (CTs) (Bhat *et al.* 2013).

HTs, the derivatives of gallic acid (3,4,5-trihydroxyl benzoic acid) are toxic when taken in excess, leading to significant economic losses by morbidity and mortality in animals (Singh *et al.* 2001; Deaville *et al.* 2007). Tannin acyl hydrolase (EC. 3.1.1.20), also known as tannase, catalyses hydrolysis of ester bonds in HTs and gallic acid esters (Bhat *et al.* 1998). Hence, tannase-producing bacteria are of manifold economic importance (Bhat *et al.* 2013; Kohl *et al.* 2016).