Various condensed tannins from tropical plants as potential multi-purpose nutraceutic in ruminant feed

Take home Message Natural multi-active nutraceutics from tropical plant resources: a sustainable alternative to chemicals.

Introduction Condensed tannins (CT) are bio-reactive complex plant secondary metabolites. Protein-CT complexes could consequent affection of rumen fermentation (Min et al., 2001), allow availability of amino-acids and induce a gastrointestinal nematicidal action in ruminants (Marie-Magdeleine et al., 2010). In this study the CT composition of 5 tropical plants was quantified and elucidated to provide some natural multi-active nutraceutics to animal production.

Material and methods CT were extracted using acetone/water (3:7; v/v) and derivatised with benzyl mercaptan before HPLC (water:acetonitrile gradient with 1% acetic acid) and LC-MS analysis for flavan-3-ols and benzyl mercaptan adducts quantification at 280 nm, and terminal and extension units identification. CT content, polymerisation degree (mDP) and procyanidin/prodelphinidin ratio (PC/PD) were determined. CT extracts were assayed for bioactivity against the exsheathment of the nematode *Haemonchus contortus*, using up to 6 concentrations and repetitions with Phosphate Buffer Sample (PBS) as control. The fermentation profiles (CH_4 and NH_3-N produced, organic matter digestibility (OMD)) were determined by incubating pure plant substrates in rumen mixed bacteria cultures (buffer solution:rumen fluid at 2:1, v/v) for 24h at 39°C; with 3 repetitions and 2 samples of perennial ryegrass (PRG*)* as control. Chemical composition and CT content (vanillin-H_2S0_4 assay) were determined. Data were analysed using the linear mixed model with plant species and concentrations as fixed effect, repetition as random effect and then expressed as a ratio of mean PRG (fermentation profile) or PBS (nematicidal effect) values.

Results Thiolysis analysis showed that CT extracts contained from 1.7 to 59 g of CT per 100g. mDP ranged from 3.3 to 15.3, PC/PD ratios from 0 to 10.7, cis/trans flavan-3-ol ratios from 1.7 to 24.7, and galloyl groups from 0 to 37.4 %. CT had a high effect ($p<0.001$) on nematicidal activity (figure 1) and fermentation profile (figure 2). At high levels of CT, differences were observed between plants: less nematicidal efficacy and more NH_3-N production for *L. Leucocephala*; higher N protection and OMD for *T. catappa*.

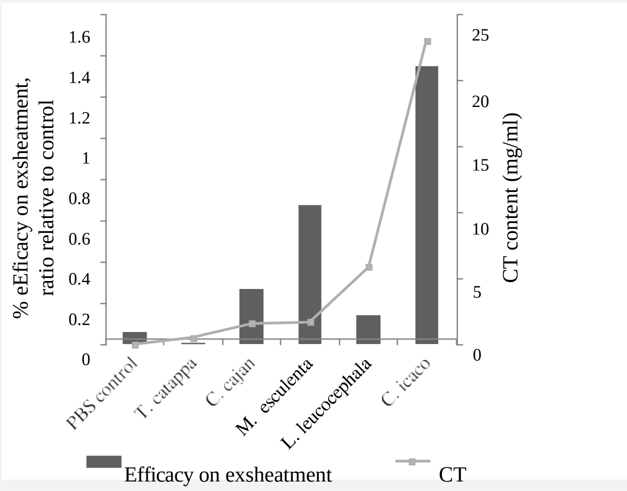

Figure 1. Effect of CT extracts from 5 tropical plants on *H. Contortus* L3 exsheathment.

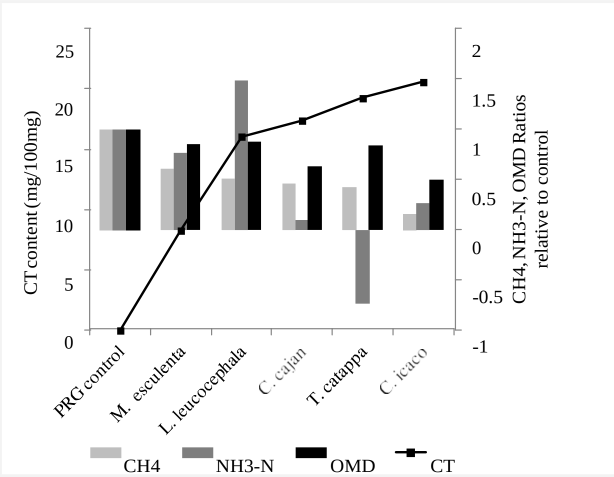

Figure 2. Effect of 5 CT-containing tropical plants on OMD, CH_4 and NH_3-N production.

Conclusion This is the first step of a study for CT multipurpose use in animal production. To our knowledge, this is the first comprehensive CT analysis for these plants. The complexity of composition of CT in tropical plants and their multipurpose potential for animal production were highlighted. It seems that CT composition may influence bio-reactivity. These results encourage further investigations to determine optimal strategies for the use of CT-rich tropical plants as multi-active nutraceutics.

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References

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