

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

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

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

Material & 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 a control. The fermentation profiles (CH₄ and NH₃-N produced, organic matter digestibility (OMD)) were determined by incubating pure plant substrates in rumen mixed bacterial 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 a control. Chemical composition and CT content (vanillin-H₂SO₄ assay) were determined. Data was analysed using the linear mixed model with plant species and concentrations as fixed effects, repetition as a random effect and then expressed as a ratio of mean PRG (fermentation profile) or PBS (nematocidal effect) values.

Results Thiolytic 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 nematocidal activity (Figure 1) and fermentation profile (Figure 2). At high levels of CT, differences were observed between plants: less nematocidal efficacy and more NH₃-N production for *L. Leucocephala*; higher N protection and OMD for *T. catappa*.

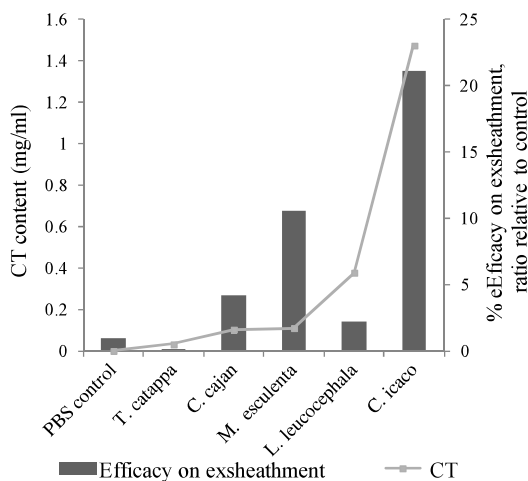


Figure 1 Effect of CT extracts from 5 tropical plants on *H. Contortus* L3 exsheathment.

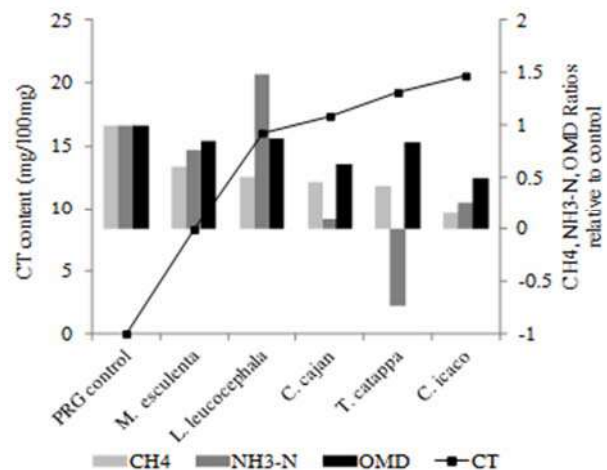


Figure 2 Effect of 5 CT-containing tropical plants on OMD, CH₄ and NH₃-N production.

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 nutraceuticals.

Acknowledgements This research was partly supported by the Region Guadeloupe FEDER project Agroecodiv.

References

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