# Mobilizing tropical plants as a sustainable alternative to the issue of anthelmintic resistance in small ruminants

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# Introduction

Condensed tannins (CT) are **complex polyphenolic secondary metabolites** from plants. **Protein-CT complexes in ruminants** could result in affection of **rumen fermentation** (Min et al., 2001), allow **availability of amino-acids** and induce a gastrointestinal **nematicidal action** (Marie-Magdeleine et al., 2010). A preliminary study was conducted in order to evaluate *in vitro* the effect of several CT types, against various **chemical-resistant strains** of the parasite *Haemonchus contortus*.

# Materials and Methods

Study of **CT from 8 plant species from 6 botanical families** (CT 1 to CT 8).

- **Extraction**: acetone/water (3:7; v/v).
- Chemical **quantification and elucidation:** thiolysis, LC-MS : Procyanidin/Prodelphinidin ratio
- Biological activity : **Drug resistance** against thiabendazole (Thia), Moxidectin (Mox), levamisole (Lev), ivermectin (Ivm) ; and CT **Anthelmintic *in vitro* assays** against L3 stage migration and exsheathment of 5 strains of ***H. contortus*** (B, C, G, J and R) : 5 concentrations of CT and 3 repetitions, PBS control. Calculation of efficient concentration for 50% inhibition EC50.

# Results

**Figure 1. Drug resistance of *H. contortus* strains**

| % L3 migration | | | |
|---|---|---|---|
| **Chemical drug** | | ***H. contortus* strain** | |
| Thia | 57.6[a] | B | 18.0[cd] |
| Mox | 33.4[b] | C | 47.9[a] |
| Lev | 8.5[c] | G | 11.1[d] |
| Ivm | 8.1 | J | 33.6[b] |
| | | R | 24.1[bc] |

**Strains G, J, B an R : Resistant to MOX and THIA, susceptible to IVM and LEV**

**Strain C : Multi-resistant to IVM, LEV , MOX and THIA**

**Figure 2. Prodelphinidin content in condensed tannins**

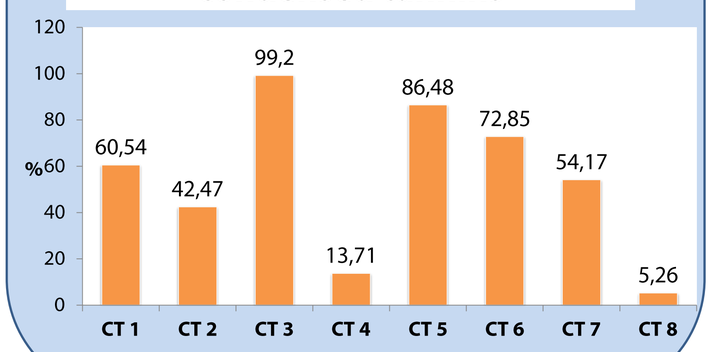
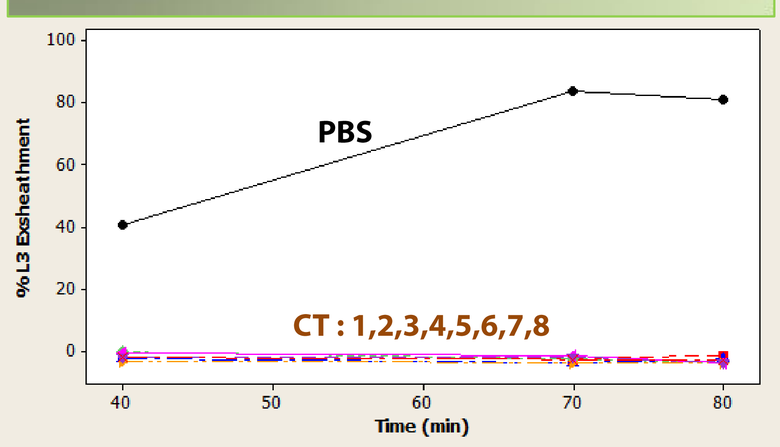
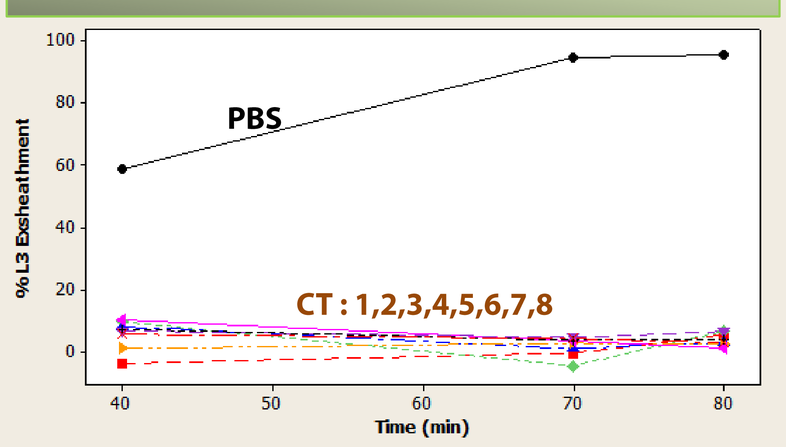



**Figure 3. Effects of condensed tannins on the exsheathment kinetics of three strains of *H. contortus***

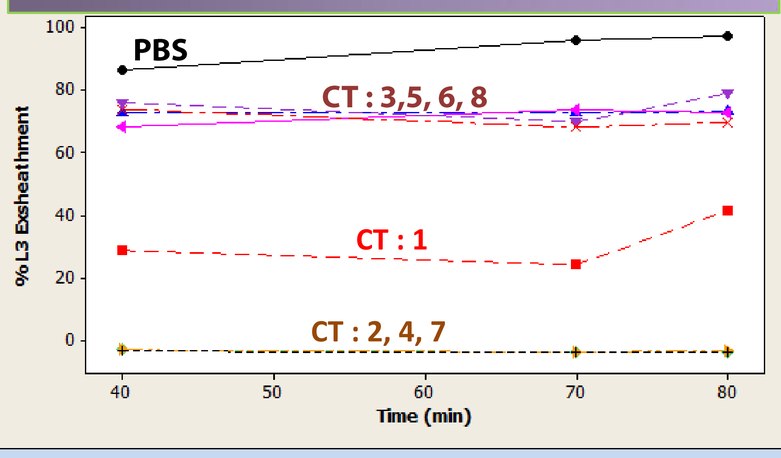
**Strain G : low level of resistance**




**Strain J : medium level of resistance**




**Strain C : Multi-resistant**




- **Different exsheathment speeds according to drug resistance level**
- **Effective CTs on resistant strains**
- **CT various efficiencies** (9 to 100 % efficacy; EC50 from 1.36E-6 to 1mg.mL-1), **decreasing with the multi-resistance of the strain** :
  - 44% efficiency between the most resistant strain and the most susceptible to CT
- **The more resistant the strain to drugs, the more resistant it is to CT.**

# Conclusion

It seems that the **structural complexity of condensed tannins**, the presence of other active compounds in the plant extracts, but also **the nature of the parasite resistance**, could affect the **tannin-protein interactions.**

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