Effect of extractives on durability of *Prosopis juliflora* heartwood

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Context of the study

Important deficit of wood in Kenya due to increasing demand of raw material for wood and paper industries and increase of the population

Logging ban effected by the government in 1999 in the Kenyan forest plantations which are mainly constituted of Pines, Cypress and Eucalypts

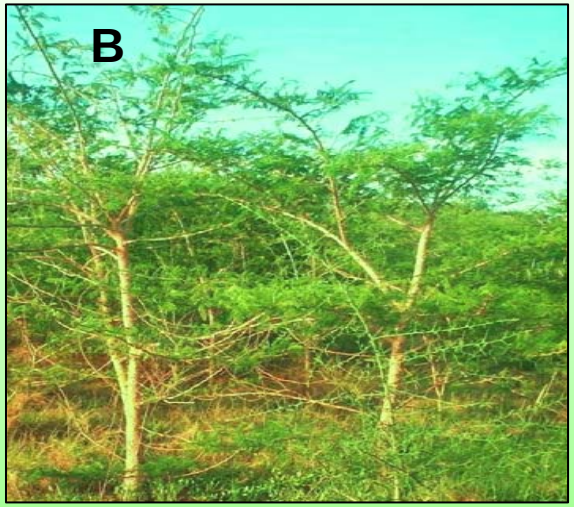
Deficit of wood in Kenya is growing and estimated to 6.841.000 m^3 in 2020

Increasing interest for alternatives to reduce pressure on wood resources (better use of wood through improvement of its durability, valorization of non durable or under exploited species…)

The problem with *Prosopis juliflora* in Kenya…

- *P. Juliflora*, native from South and Central America, was introduced in Kenya in the early 1970's to remedy to environmental problems.

- Now, it caused numerous problems due to its invasive character…



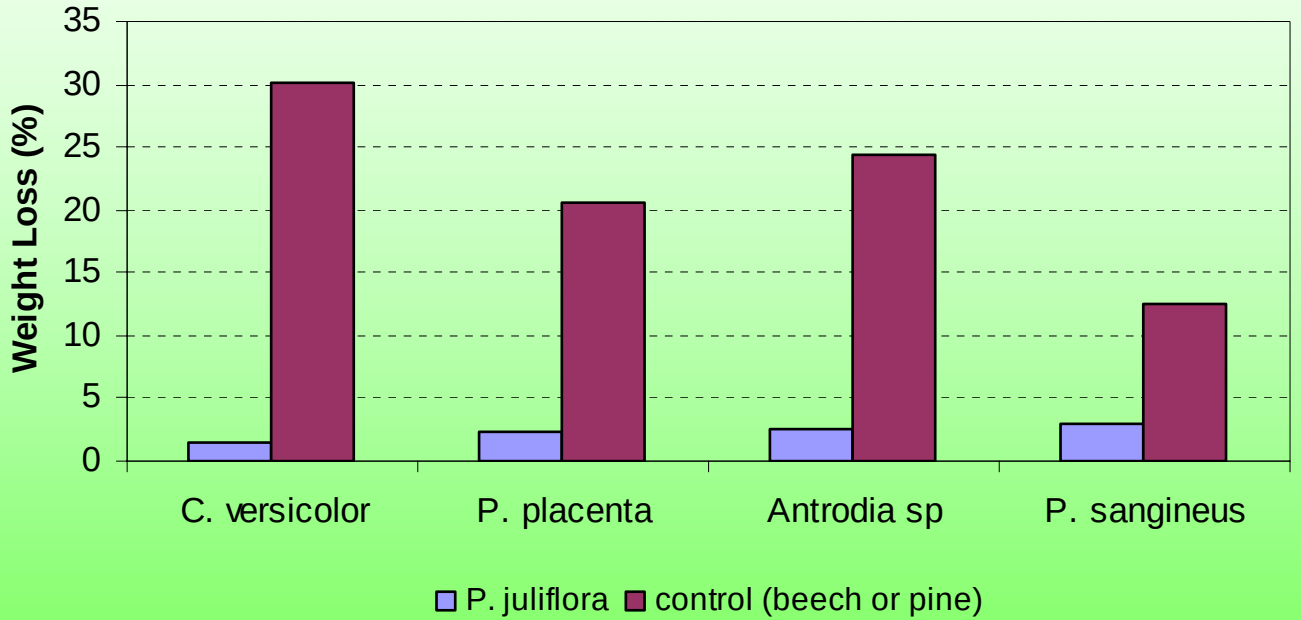
A. Over growing road network **B**. Colonizing agricultural land **C**.Thorns that cause injury

- The aim of this research is to take benefit of this invasion to develop potential new resources for the local population through the development of efficient utilizations of *P. juliflora* wood

- Natural durability of *P. juliflora* heartwood to fungi and termites

Natural durability against fungi

- Mini-blocks heartwood samples 35mm × 25mm × 5mm (l, r, t)
- Several fungal species:
  Coriolus versicolor, Poria placenta, Antrodia sp, Pycnoporus sanguineus
- Exposed to fungi on malt agar medium



Weight losses of wood samples after four months exposure to fungi

➢ Under laboratory conditions used, *Prosopis juliflora* heartwood is resistant to the different wood rotting fungi

Extractives content determination

Percentage extractives from heartwood

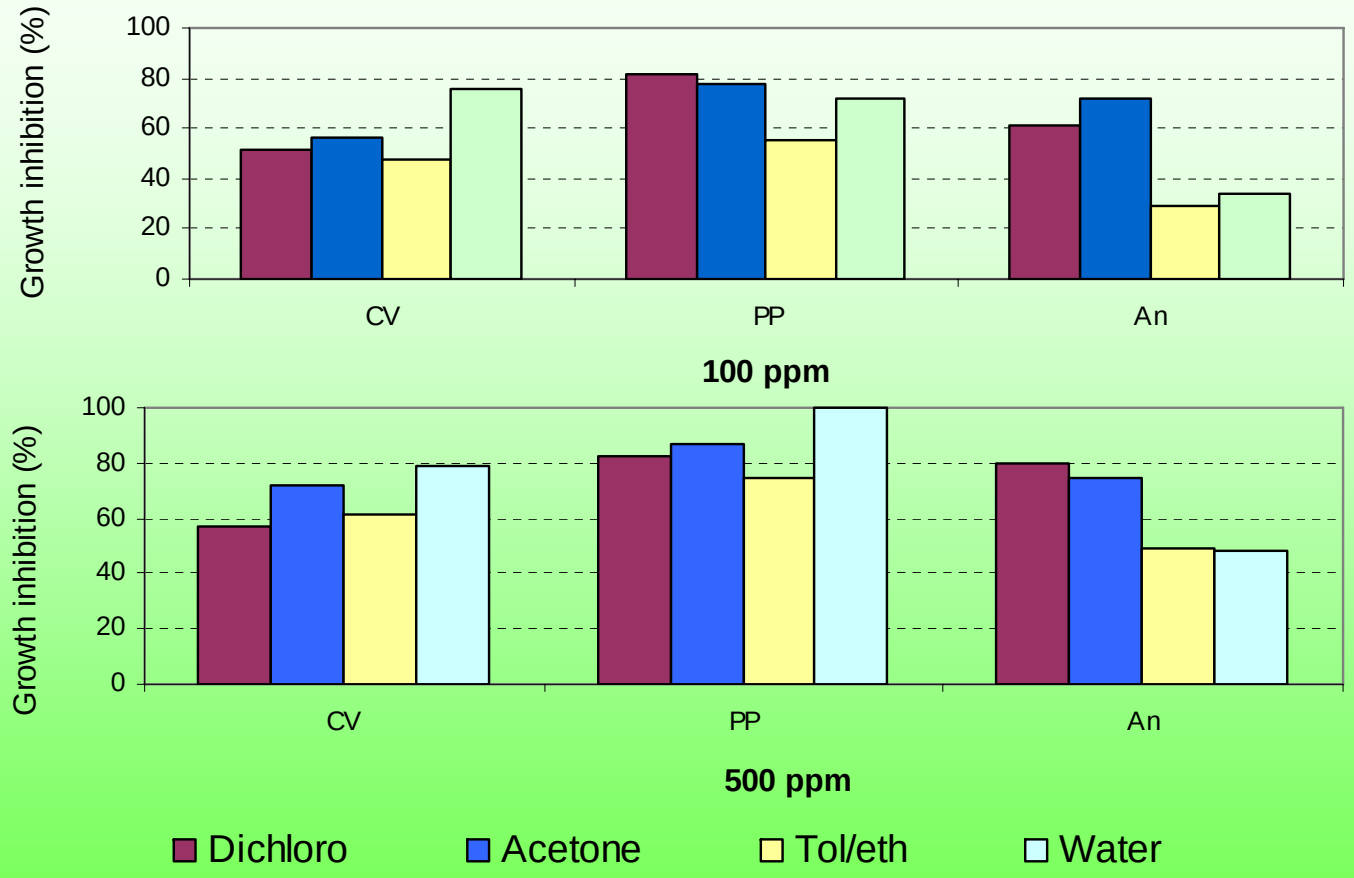
Solvent	Indirect method [a]	Direct method [b]
Hexane	2.7	2.4
Dichloromethane	3.7	3.4
Acetone	7.7	7.6
Toluene/Ethanol	9.6	8.9
Water	10.8	10.6

[a] obtained by difference of sawdust mass before and after extraction

[b] calculated from extractives weight after evaporation of the solvent

Effect of extractives on fungal growth

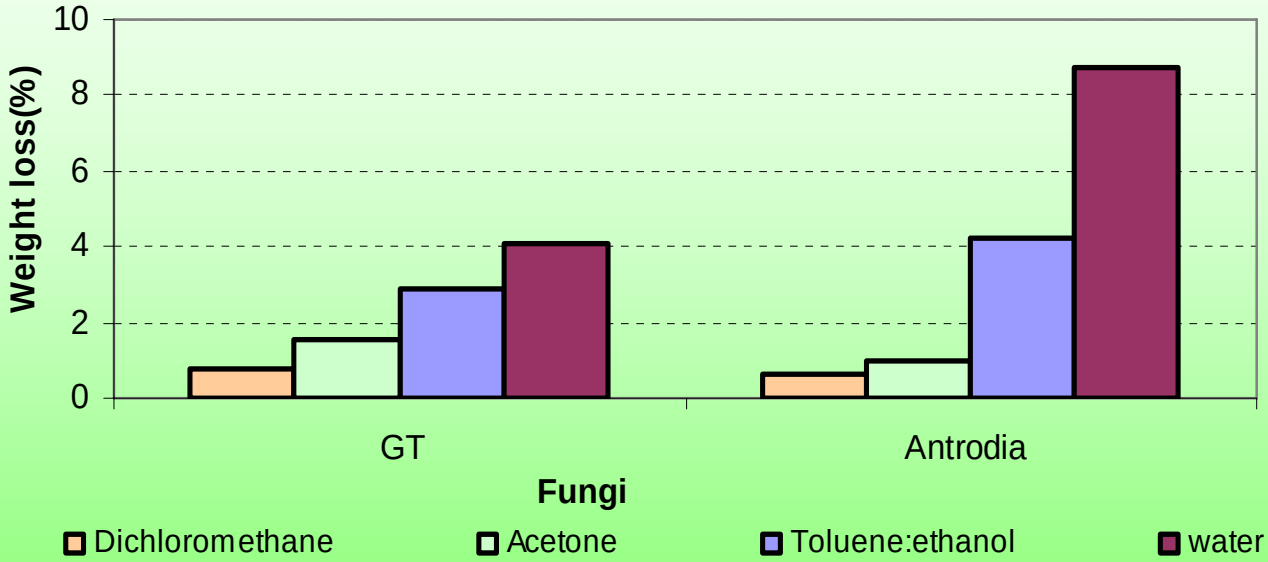
Mycelium growth inhibition tests with different concentrations of extractives



- Independently of the solvent, all extracts slow down mycelium growth

Effect of extractives on durability to fungi

- Mini-blocks were Soxhlet extracted with different solvents
- Exposed to fungi on malt agar medium



Weight losses of wood samples extracted or not after four months exposure to fungi

➢ Extracted samples are less resistant than unextracted ones

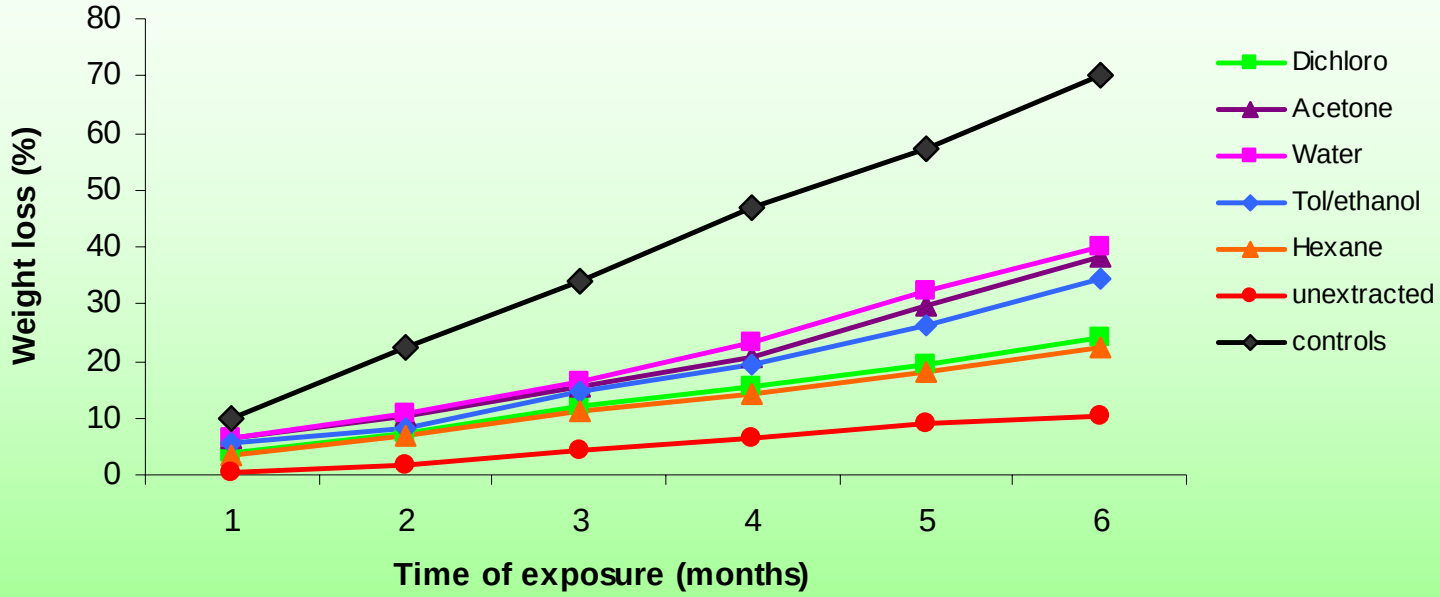
Natural durability against termites - Field tests

Termite field layout at Kerio Valley, Kenya

- *Macrotermes natalensis* termites common in Kenya

- Evaluation was performed according to AWPA: E7-1993 standard used for determination of resistance to subterranean termites

Effect of extractives on termite's wood resistance



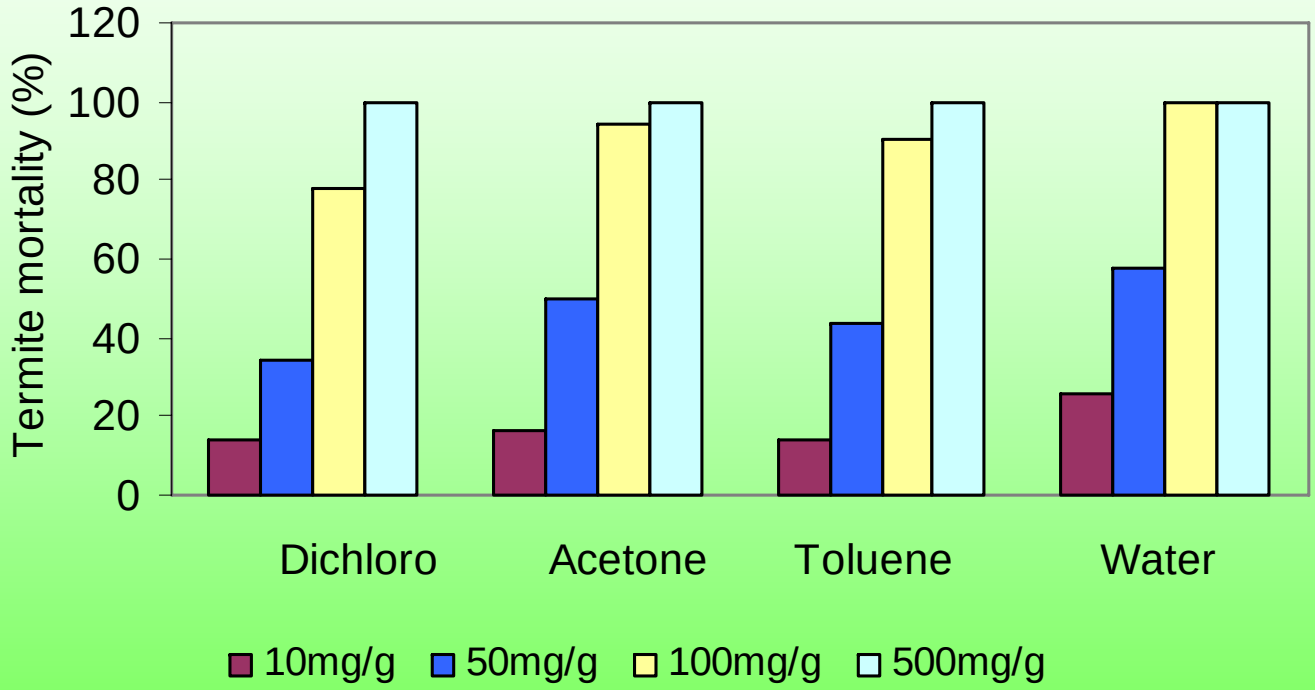
Effect of extractives removal on resistance of *P. juliflora* heartwood to termites

- Wood degradation was more important for extracted samples comparatively to unextracted ones or pine control.

Termicidal properties of extractives

- No choice bioassay performed on Whatman filter paper impregnated with different extractives concentrations (10, 50, 100 and 500 mg/g)

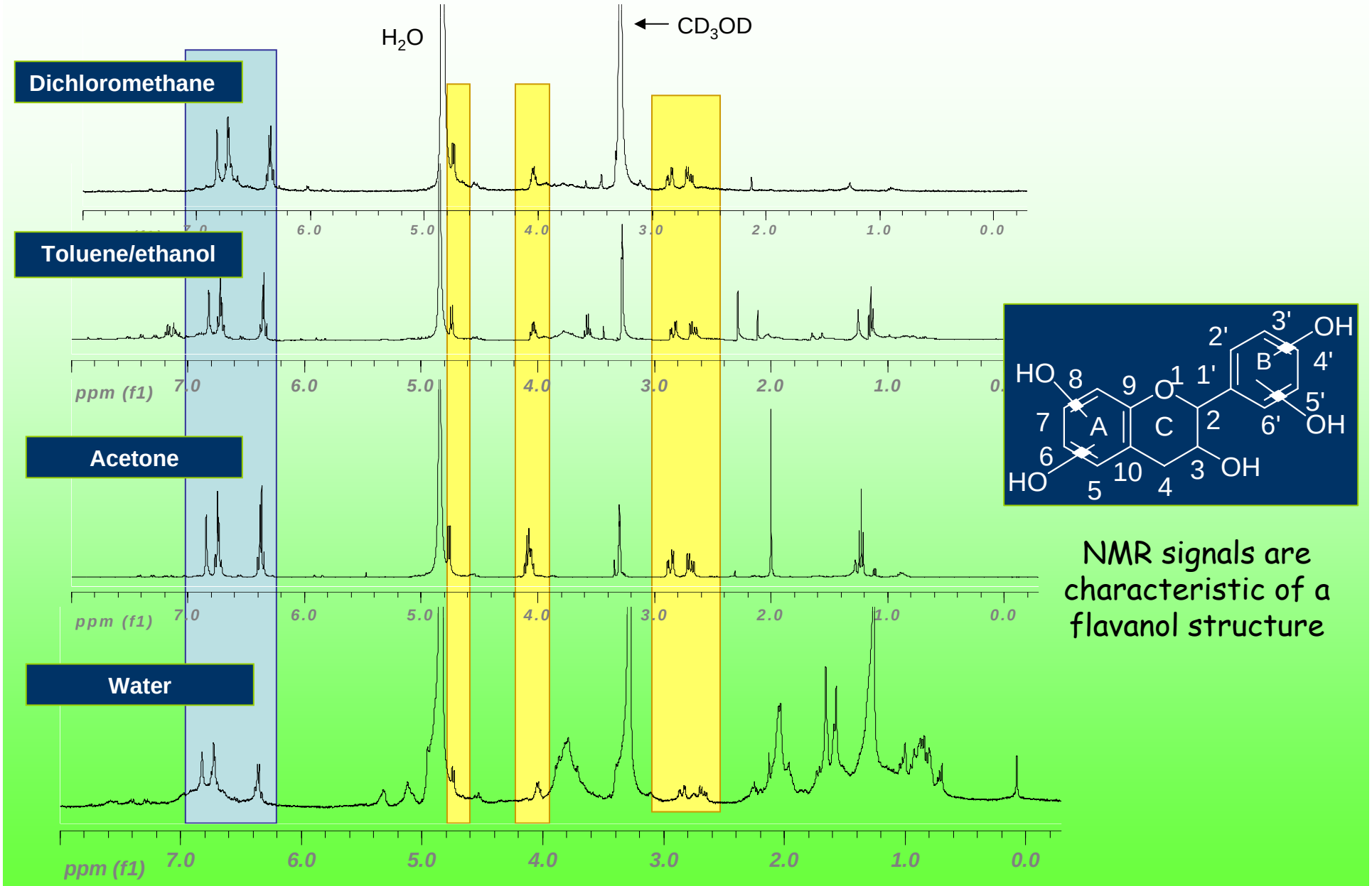
- *Macrotermes natalensis*



Mortality caused by heartwood extractives after 14 days

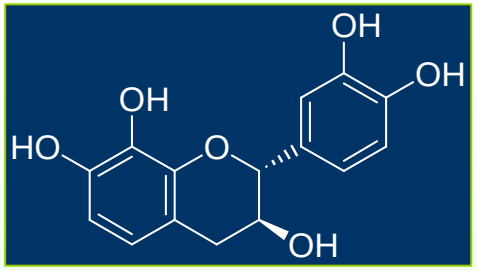
➢ Extracts used at high concentration caused important mortality of termites

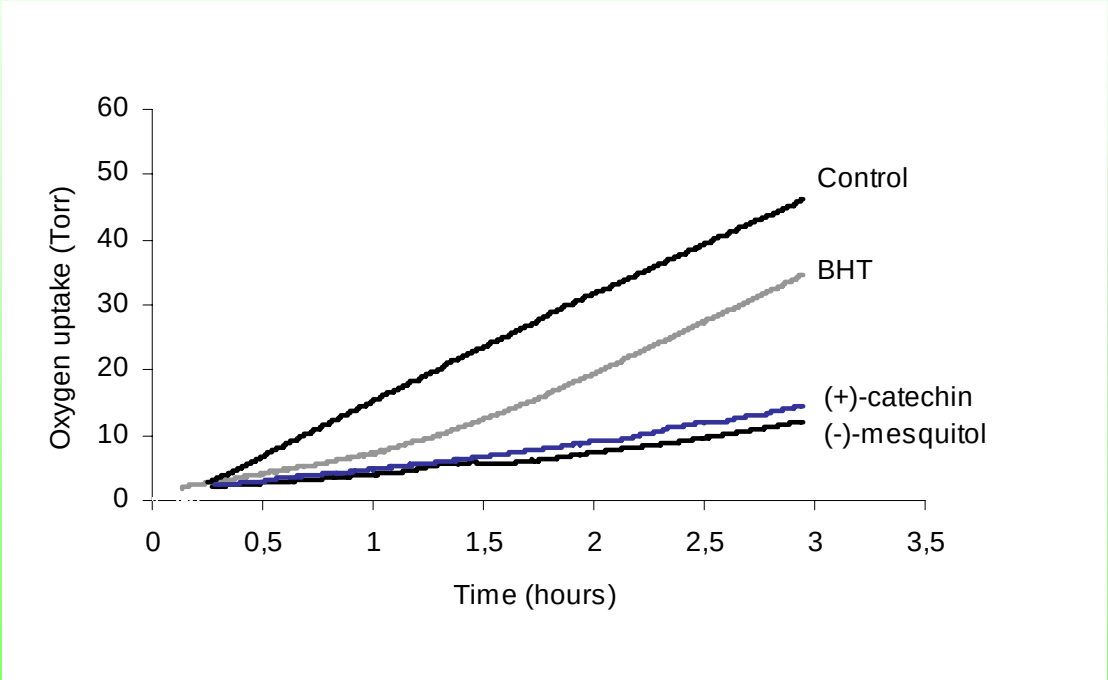
Characterization of the different heartwood crude extractives by ^{1}HNMR



NMR signals are characteristic of a flavanol structure

Additional analysis by GC-MS, HPLC, FTIR or 2D NMR and comparison with reference flavanols allowed unambiguous assignments of the structure to (-)-mesquitol





Antioxidant properties estimated using methyl linoleate oxidation inhibition

➢ Strong antioxidant properties, which could be at the origin of wood durability to decay

Conclusions

- Decay's and termite's resistance of *P. juliflora* wood allow to envisage its use as an alternative to the declining wood resources in Kenya

- Decay's and termite's durability is associated to the presence of extractives

- High amount and high purity of mesquitol possessing strong antioxidant properties can lead to valuable valorization

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Thank you for your attention