WOOD CHEMISTRY COMPLETES NATURAL DURABILITY AS CRITERIA FOR SHORTING BEST ~~PROVENANCES IN THE IMPROVEMENT OF TEAK~~ WOOD QUALITY:

CASE OF FIVE PROVENANCES FROM THE IVORIAN SÉGUIÉ'S TRIAL

Florence Bobelé Niamké, Nadine Amusant, Augustin Amissa Adima

Introduction

Teak is an important, highly valuable hardwood found on the international timber market. It is from Asia but it is present in tropical zones like Africa.

In Côte d'Ivoire, teak plantations covering around 60 000 ha, were spread in all the country and are mainly administrated by SODEFOR (Forest Development Society)

Several trials were established in the 1970'ies, for genetic improvement by FAO.

Introduction

Two trials: Séguié, Rubino in 1970 (South), and Téné, Oumé (West) in 1974

Seeds from localities of Thailand, Tanzania, Senegal, India, Côte d'Ivoire, Cameroon, and Benin (Dié et al. 2015; Fofana et al. 2014).

Unfortunately, data about the wood quality of these provenances are not available.

Introduction

Many criteria were used to determine teak quality:

- ✓ morphological and phenotypical traits such as stem diameter, straightness, budressing ;
- ✓ physical, mechanical and technological properties such as the wood density and stability, colour of heartwood, and natural durability (Kokutse *et al.* 2009).

Introduction

Teak natural durability is a critical quality criterion and an important deciding industrial feature.

Teak natural durability is variable : from class 1 to class 4.

It is impacted by its chemistry, especially, its extractives content (Niamké et al. 2011).

Heartwood extractives and natural durability (fungi resistance)

Phenolic compounds of teak wood	Correlation coefficient with relative mass loss
1,4-Naphthoquinone	-0.27 ns
2-(Hydroxymethyl)anthraquinone	-0.82 **
Anthraquinone-2-carboxylic acid	-0.13 ns
Lapachol	-0.10 ns
Tectoquinone	-0.79 **
Heartwood extract	-0.86 **
4',5'-dihydroxy-epiisocatalponol (P1)	-0.90 **

** significative at 1% level; ns not significative at 5% level

We hypothese that teak wood extractives can help to select most interesting materials

Introduction

Aim of study :

To investigate the decay resistance and the content of chemical (non-structural carbohydrates and phenolics) of five provenances planted in Côte d'Ivoire in order to select the best one

Experimental methods

Plant material From the trial of Séguié, Rubino

Experimental methods

Plant material From the trial of Séguié, Rubino

2 provenances from Africa

Provenance number	Country	Locality	Latitude	Longitude	Altitude (m)	Rainfall (mm)
4	Côte d'Ivoire	Bamoro A20	7°48	5°05	300	1200
12	Thailand	Pong Salee	19°8	100°1	350	1500
16	India	Nellicutha	11°17	76°14	35	2700
17	Tanzania	Mtibwa	6°	37°39	460	1160
20	India	Virnoli range	15°	74°	520	2030

3 provenances from the native zone

Experimental methods

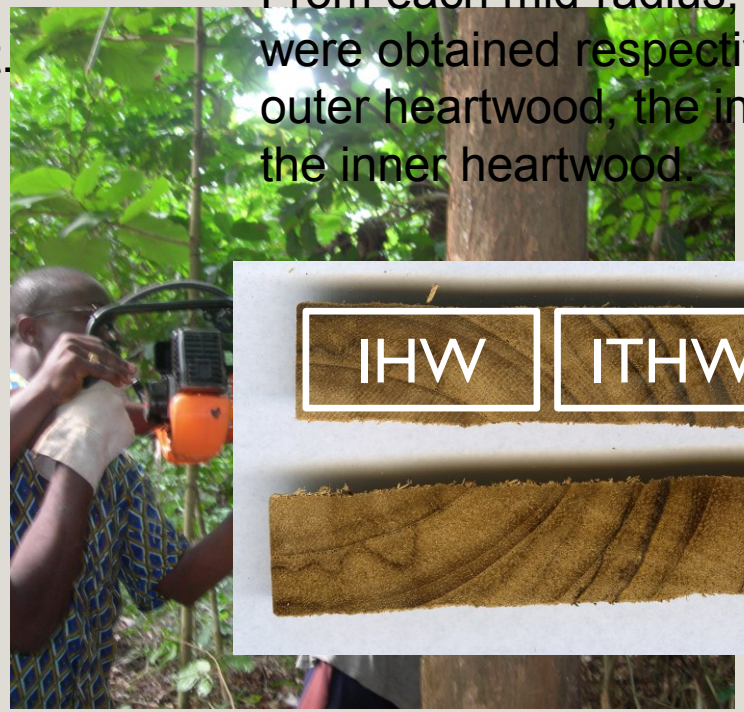
Plant material

Wood cores were harvested at breast height.

The cores were conserved in a control room (70% of humidity at 21°C).

Each wood core was divided in two radii: one radius for the chemical analyses and the second for the decay resistance test.

Each wood radius was divided into 2 mid-radius. From each mid-radius, 4 samples (2.5 cm of side) were obtained respectively in the sapwood, the outer heartwood, the intern and the inner heartwood.



Experimental methods

Decay resistance: An adapted method of the XP 15083 was used. The classification was done according the AFNOR EN 350-2.

Chemical analyses: Total phenolic content was determined by HPLC while non-structural carbohydrates content was quantified using spectroscopic method after enzymatic reaction. as described by Niamké *et al.* (2011).

Statistics: The XLSTAT software package (Paris, France).

Results and discussion: sapwood decay resistance

Legend:

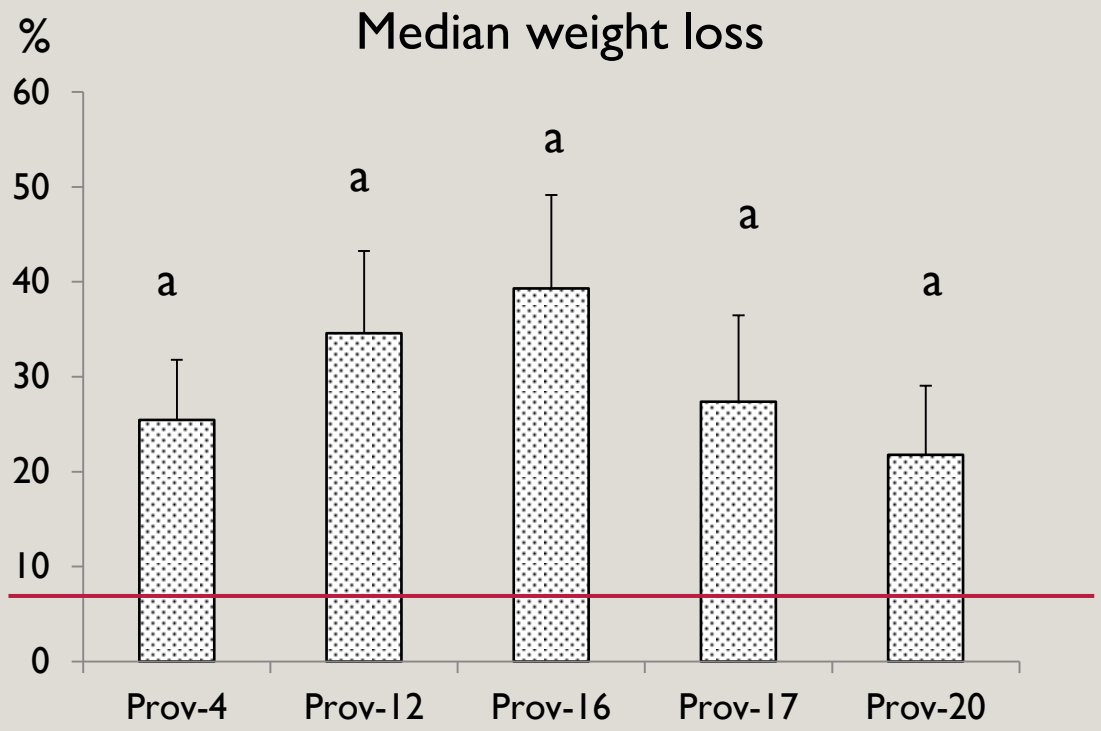
4 Bamoro Côte d'Ivoire

12 Pong salee Thailand

16 Nellicutha India

17 Mtibwa Tanzania

20 Virnoli Range India



Class 4: provenances 4, 17 and 20

Class 5: Provenances 12 and 16

Results and discussion: decay resistance in heartwood

Legend:

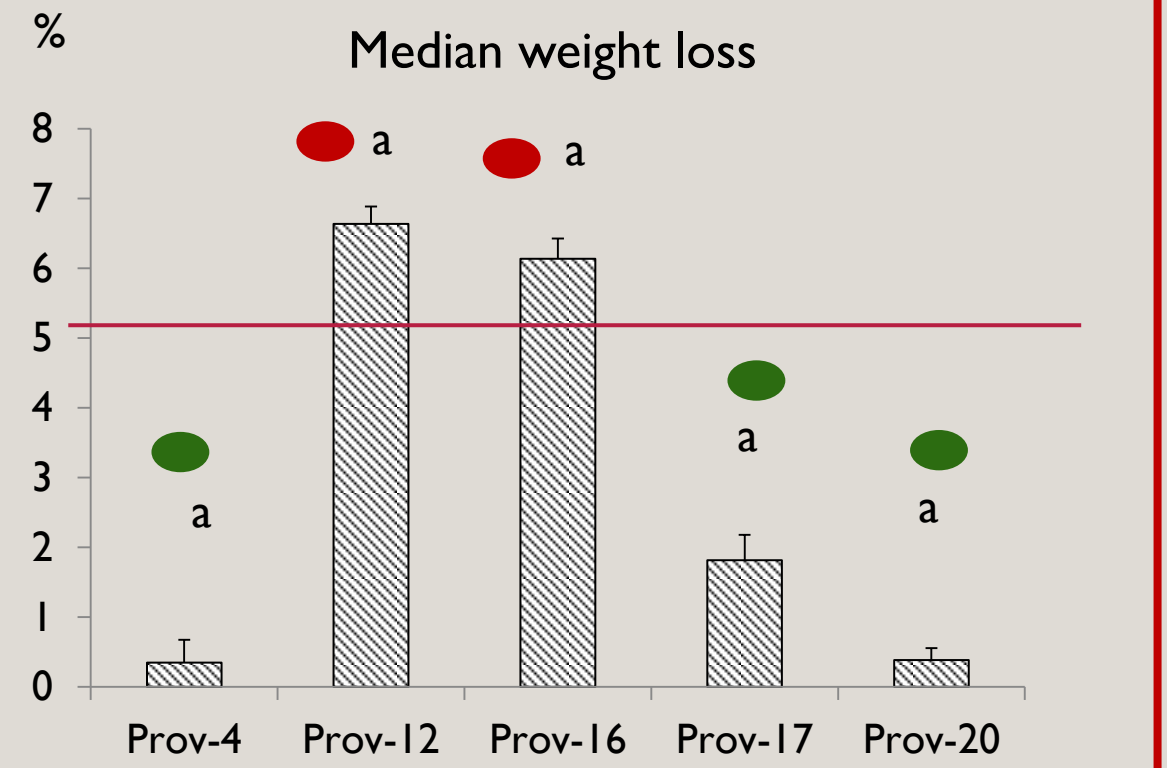
4 Bamoro Côte d'Ivoire

12 Pong salee Thailand

16 Nellicutha India

17 Mtibwa Tanzania

20 Virnoli Range India



Class 1: Provenances 4, 17 and 20

Class 2: Provenances 12 and 16

Results and discussion: phenolics content of sapwood

Legend:

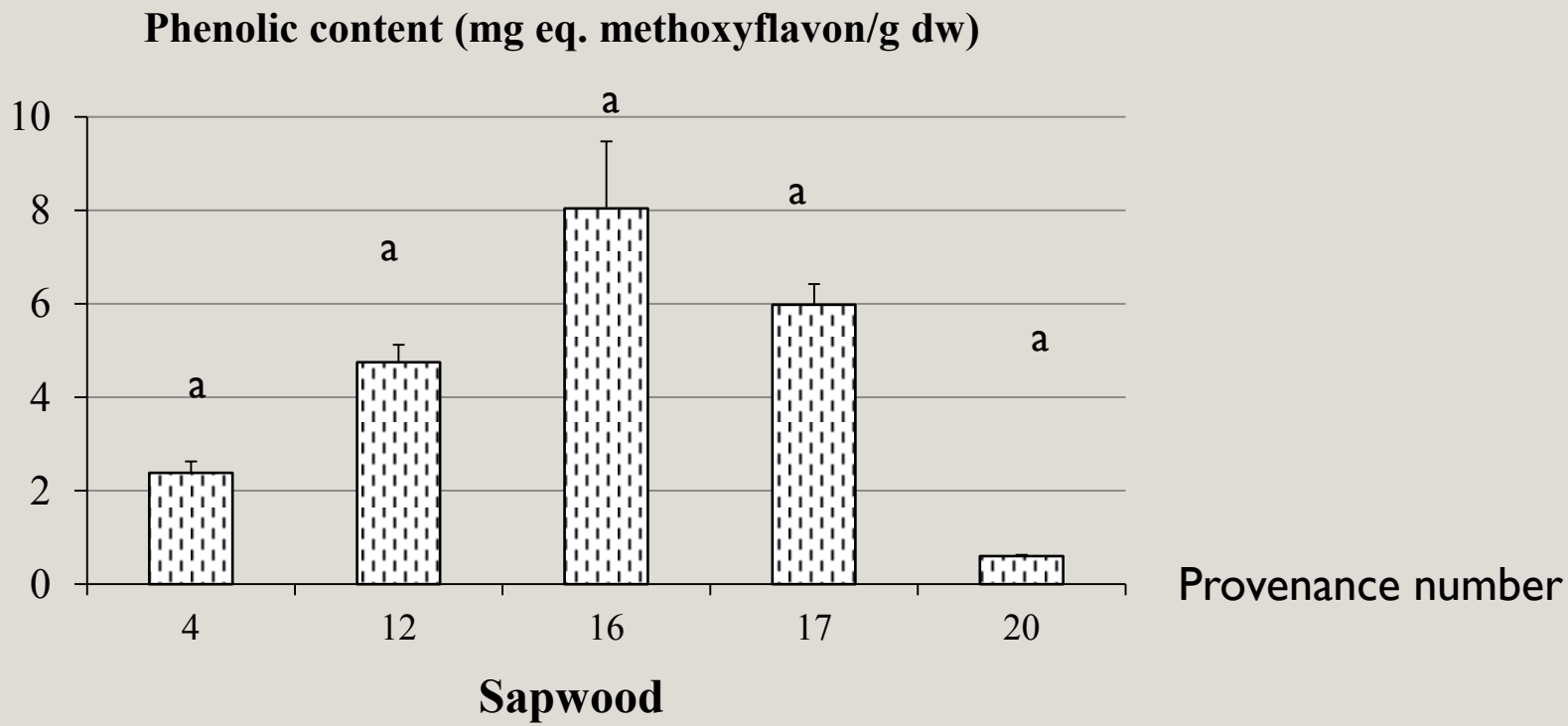
4 Bamoro Côte d'Ivoire

12 Pong salee Thailand

16 Nellicutha India

17 Mtibwa Tanzania

20 Virnoli Range India



Results and discussion: phenolic content of heartwood

Legend:

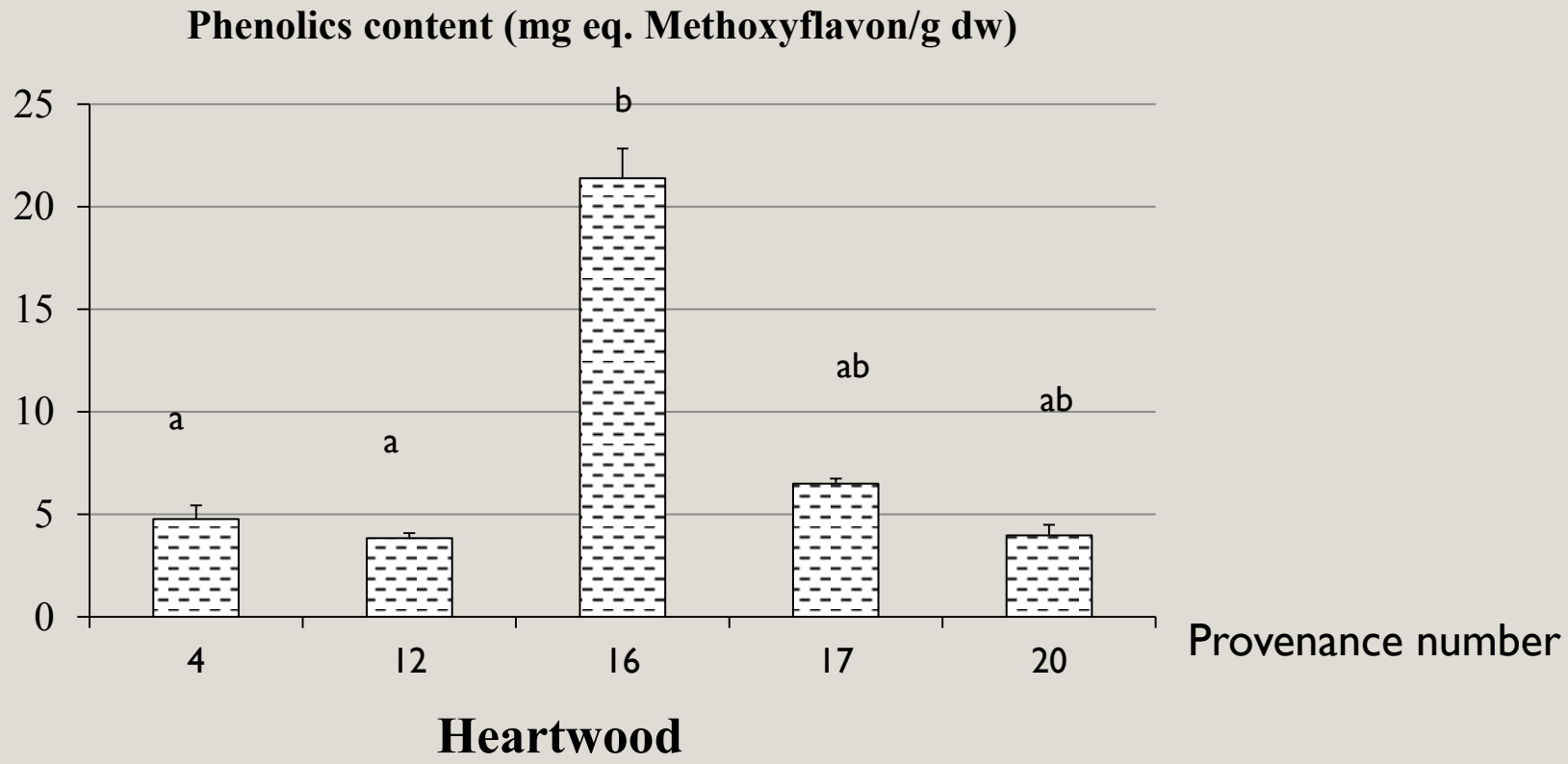
4 Bamoro Côte d'Ivoire

12 Pong salee Thailand

16 Nellicutha India

17 Mtibwa Tanzania

20 Virnoli Range India



Results and discussion: non structural carbohydrates content

Provenance	NSC			
	Glucose	Fructose	Sucrose	Starch
4	2.88±0.39^{ab}	3.90±0.63^{a}	1.25±0.13^{a}	19.03±2.39^{a}
12	1.66±0.15^{ab}	1.51±0.16^{a}	1.89±0.24^{a}	15.90±1.87^{a}
16	0.05±0.01^{c}	0.12±0.01^{a}	0.27±0.01^{a}	0.47±0.03^{a}
17	0.69±0.07^{c}	1.76±0.19^{a}	1.34±0.12^{a}	11.60±0.97^{a}
20	2.31±0.19^{c}	2.71±0.30^{a}	1.92±0.19^{a}	55.51±5.42^{a}

Legend:

4 Bamoro Côte d'Ivoire

12 Pong salee Thailand

16 Nellicutha India

17 Mtibwa Tanzania

20 Virnoli Range India

Conclusion

Common criteria: morphological, mechanical, technological, etc. are important.

It is relevant to include the chemical composition of wood, especially non-structural carbohydrates and phenolic contents of teak.

Among studied provenances, the Nellicutha Indian and the Mtibwa Tanzanian provenances presented best performance : **good natural durability together with high content of phenolics and low amount of non-structural carbohydrates**

However, further development should be done on an extensive collection including all provenances used in Côte d'Ivoire for consistent results.

Acknowledgments

Dr KOFFI N'GUESSAN, General Manager of INP-HB

Côte d'Ivoire

Yamoussoukro : Basilica notre dame de la paix

THANKS FOR YOUR ATTENTION

bobele.niamke@inphb.ci

Institut National Polytechnique
Félix HOUPHOUËT-BOIGNY