

Ring shake and anatomical characteristics of chestnut wood: is there any relationship?

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Fig. 1: Example of a ring shaken chestnut disc.

Background

Ring shake is the major obstacle to the economic exploitation of chestnut wood. It is assumed to be very common in chestnut wood because of its particular weakness.

Two basic wood characteristics may confer a particular fragility favouring ring shake development:

- ▶▶ the ring porous earlywood structure generate a clear plane of weakness in the tangential plane
- ▶▶ the thin monoseriate rays have a hard task to resist against stresses acting in the radial direction.

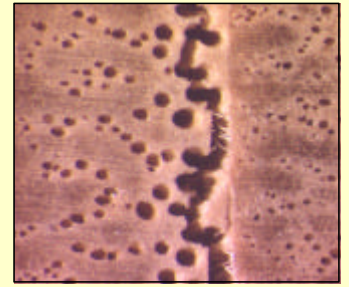


Fig. 2: Example of ring shake developing across the earlywood vessels.

Work hypothesis

Ring-shaken chestnut trees (*Castanea sativa* Mill.) display larger earlywood vessels and/or less radial rays than unshaken ones.

Material

The material of the study consists of wood discs sampled from the basis of shoots of three over-aged chestnut coppice plots located in the southern part of the Swiss Alps. All together 60 wood discs were sampled, 10 shake-free and 10 strong ring shaken discs from each plot.

Fig. 3: Ring shake distribution among sites in relationship to the mean ring width and the solar year (ageing)

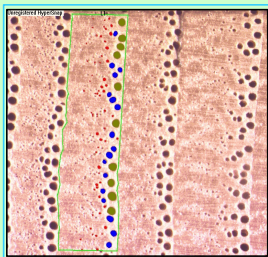
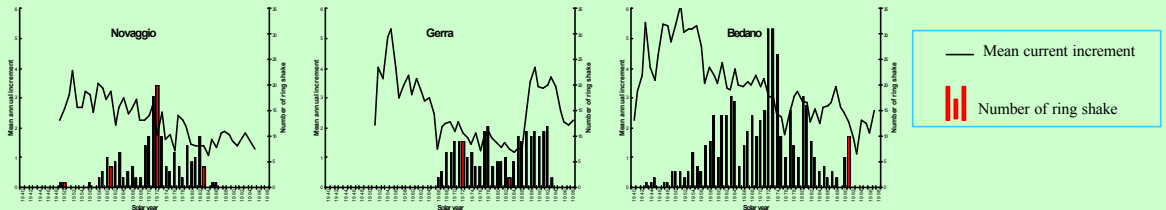


Fig. 4: Example of an analysed image. Coloured point correspond to the recognised earlywood vessels.

Methods of surveys

Anatomical characteristics were surveyed using a digital image device.

Earlywood vessels characteristics were measured for each annual ring along a radius through images captured directly on the cross-section of the polished discs (Fig. 4).

Measured characteristics: number of vessels, mean and total vessels area

Radial rays characteristics were measured using a LTSEM on 6 tangential wood sections sampled along the same radius used for earlywood measurement (Fig. 5).

Measured characteristics: Rays number and total rays area

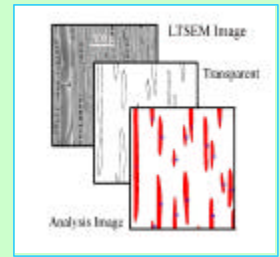


Fig. 5: Example of an analysed image. The red shapes of the foreground image represent the recognised rays.

Results

Results indicate that ring shaken wood denotes smaller earlywood vessels (Fig. 6) and a higher amount of wood rays proportion (Fig. 7) than the unshaken one. However differences are statistically significant only for earlywood vessels (for 2 of 3 plot). An analyse combining both characteristics evidences that is it possible to differentiate between shoots with and without ring shake, but only for fast growing trees (Fig. 8).

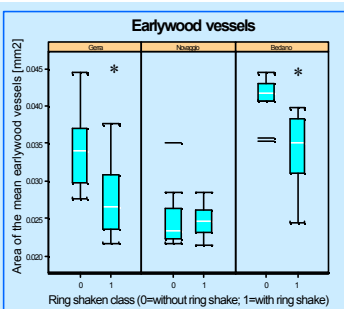


Fig. 6: Confronting analysis among vessel characteristics. * Differences in mean are significantly different.

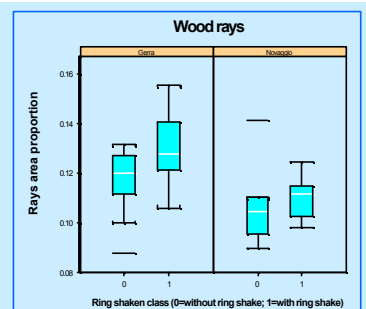
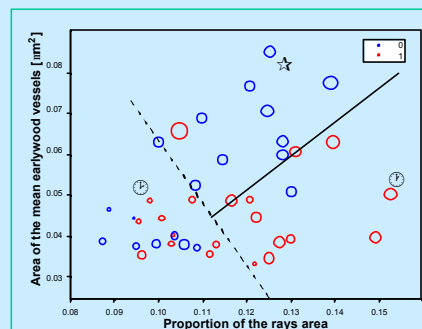


Fig. 7: Confronting analysis among wood rays characteristics.

Fig. 8: Combined analysis. The continuous line permit to divide trees without ring shake (Area ☆) from the trees displaying the defect (⊙) among those displaying larger ring width. Bubbles dimension are proportional to the mean ring width of the tree. Among slow growing trees, characterised by small earlywood and low proportion of rays, the separation between the groups is not recognisable anymore (⊙).



- Shoots with ring shake
- Shoots without ring shake
- Bubble dimension is proportional to the mean ring width of the shoots

Conclusion

Results obtained reject the work hypothesis: ring shaken trees display smaller earlywood vessels and higher amount of wood rays, properties that were supposed to increase the radial strength and therefore counteract the development of ring shake. Further research using mechanical test in order to verify whether ring shaken wood is effectively weaker than the unshaken ones are advisable to better interpret the results obtained.