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## Mechanical properties of “ Flexure Wood ”

Benjamin Niez, Jana Dlouha, Evelyne Toussaint, Joseph Gril, Bruno Moulia,  
Eric Badel

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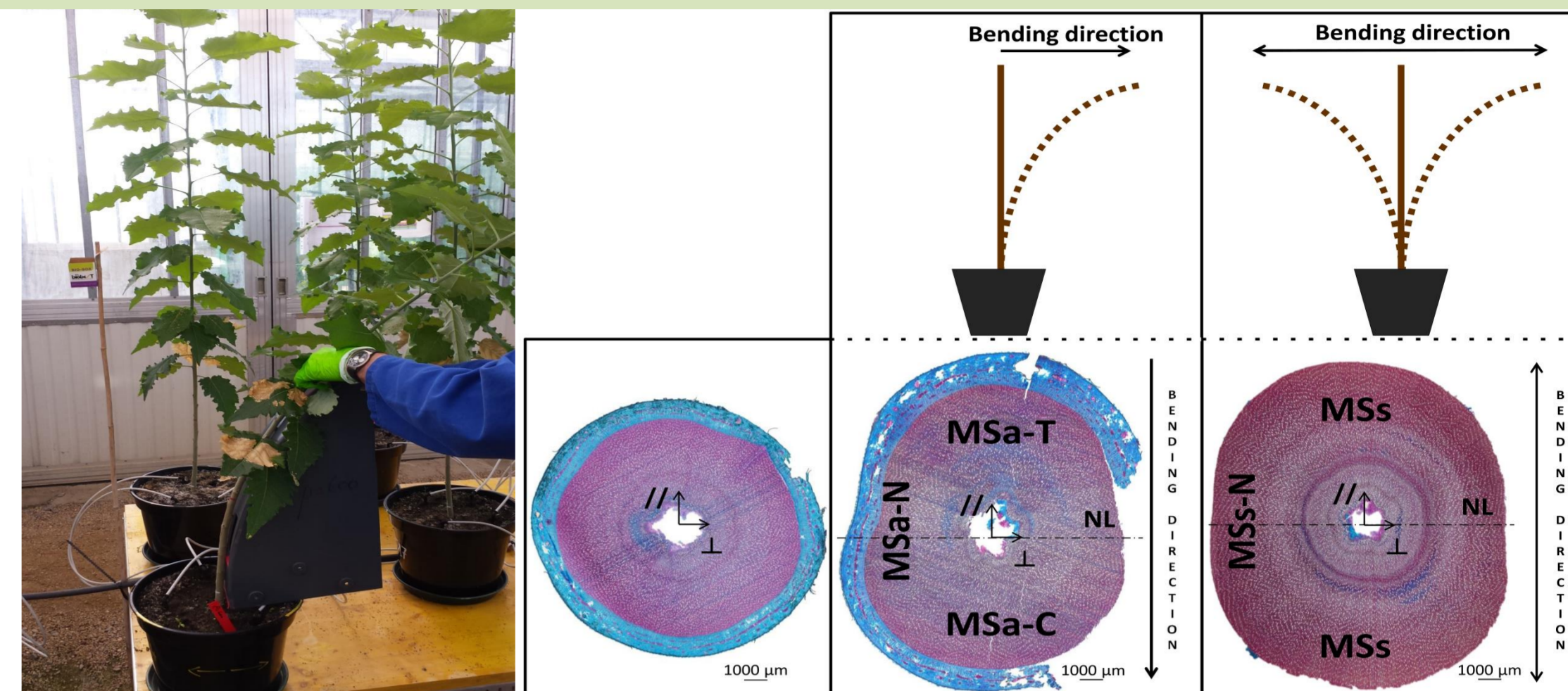
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## Wood: a complex material resulting from tree acclimation to growing conditions

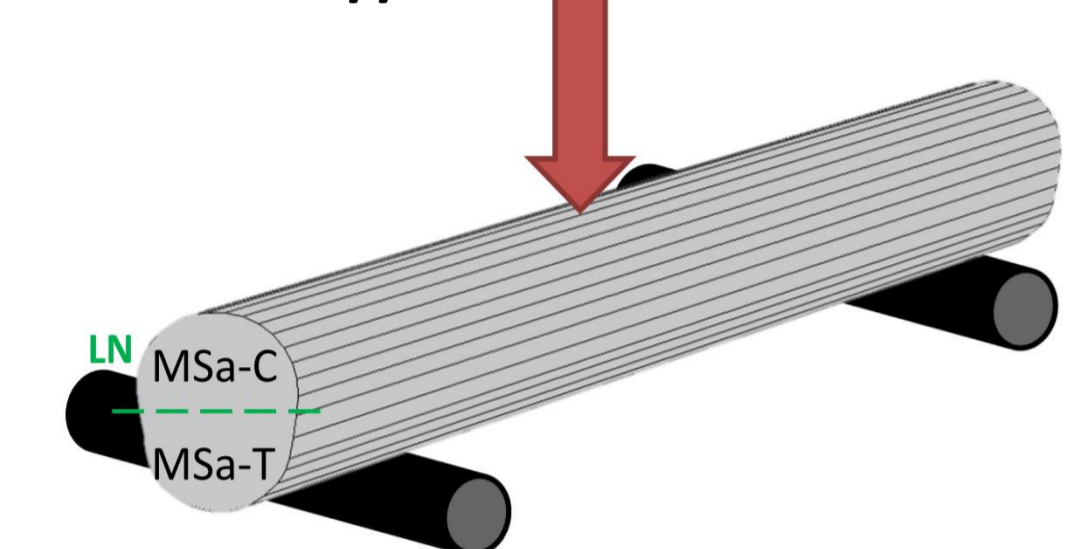
Wood ensures the mechanical stability of the trunk and branches. Its formation is impacted by windy environments: living cells sense mechanical strains and modify the formation of wood accordingly in terms of quantity and quality: these biological responses are called "Thigmomorphogenesis".

We bent young poplars three times a day, five days per week during six months. When a stem is bent, wood endures compressive and/or tensile stresses. Our objective is to determine the impact of these growing conditions on the mechanical properties of wood.

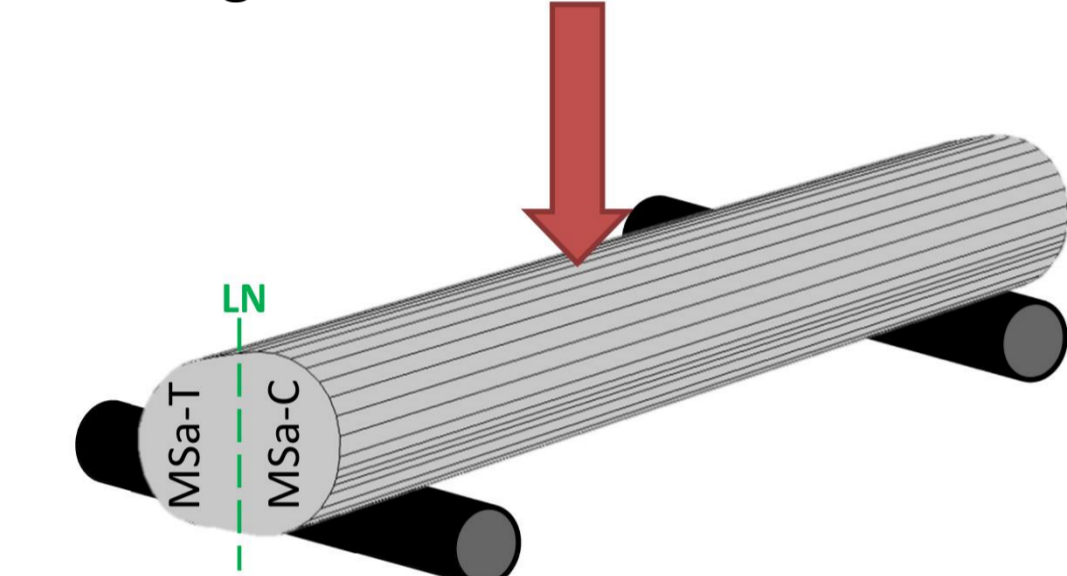


## Mechanical behaviour of the stem

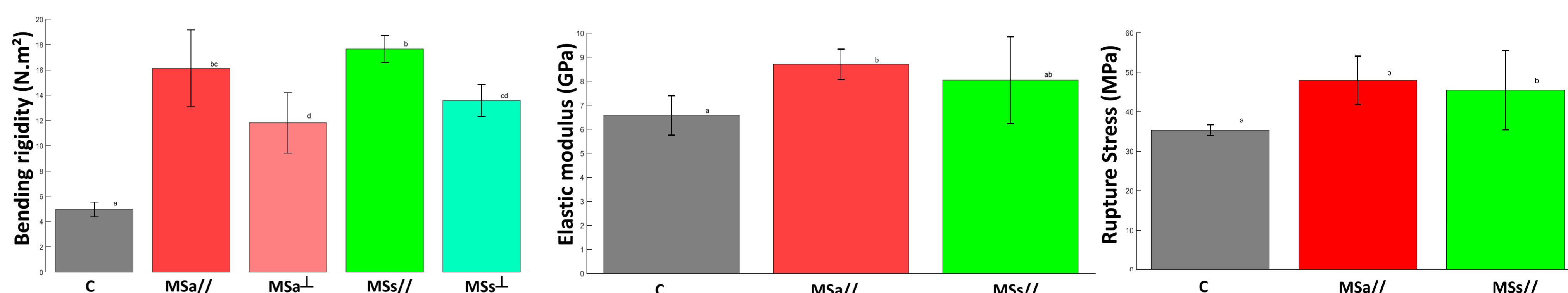
Test in the direction of bending treatments //:



Test perpendicular to the direction of bending treatments ⊥:



Control (C)	
MSa //	MSa: Mechanical Stimulation (asymmetric)
MSa ⊥	
MSs //	MSs: Mechanical Stimulation (symmetric)
MSs ⊥	



### Main results:

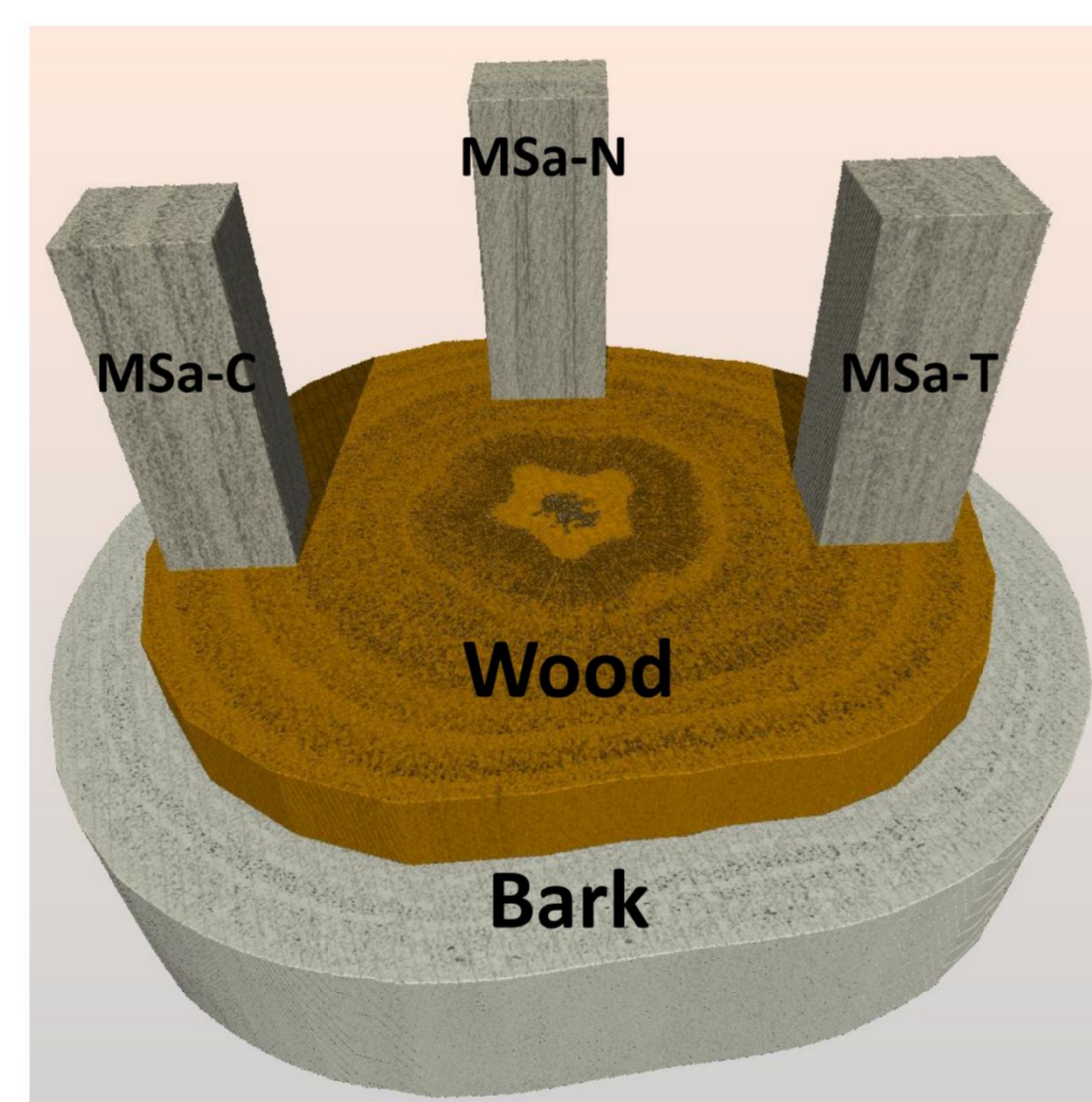
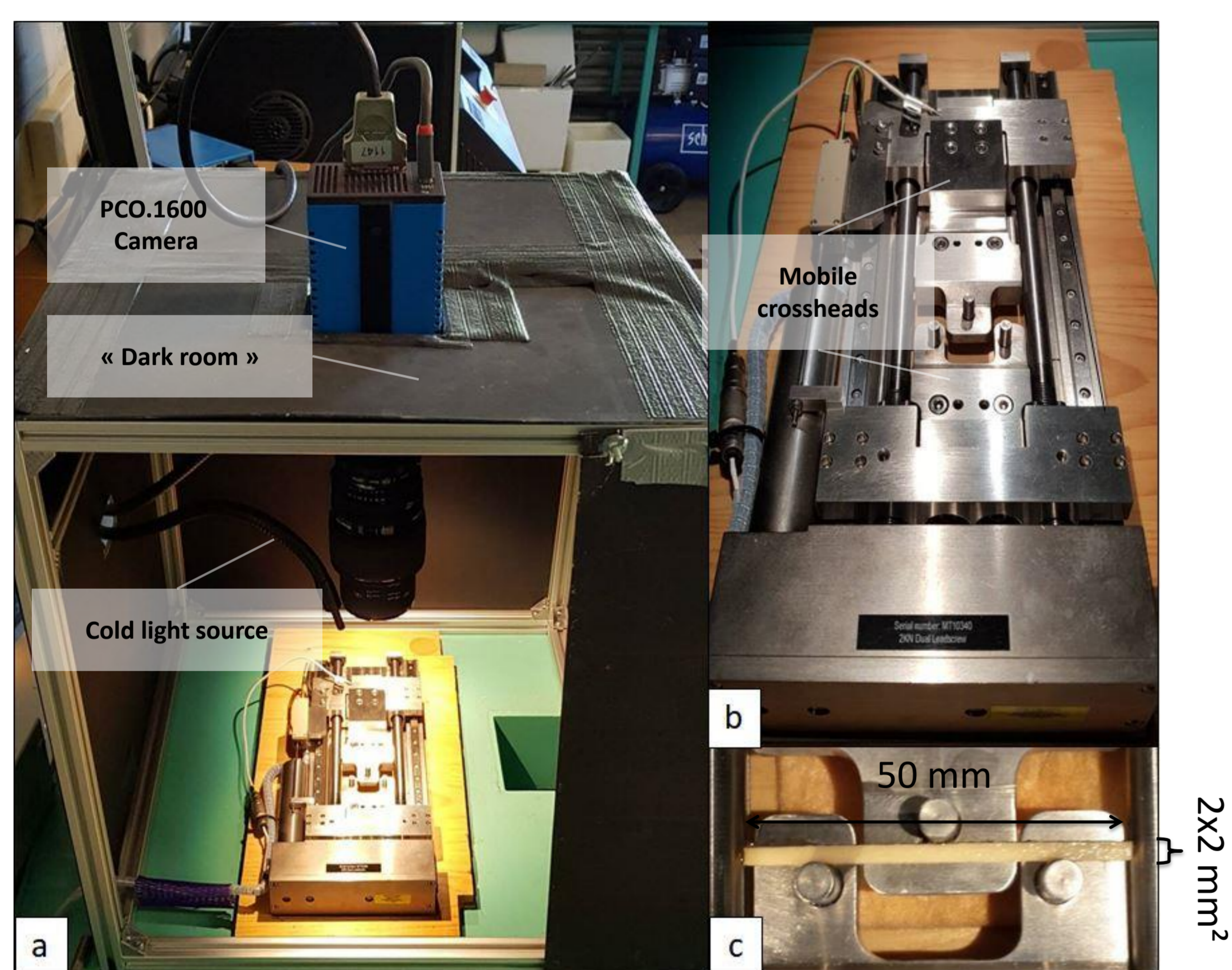
- Bending treatments dramatically enhance the stem bending rigidity (**x3.3** for MSa// and **x3.56** for MSs//)
- Asymmetrical bending increase the elastic modulus (**+32.3%** for MSa//)
- Bending treatments increase the MOR (**+35.8%** for MSa// and **+28.8%** for MSs//)

=> **Mechanical benefit of tree acclimation to bending**

## Mechanical behaviour of wood tissue

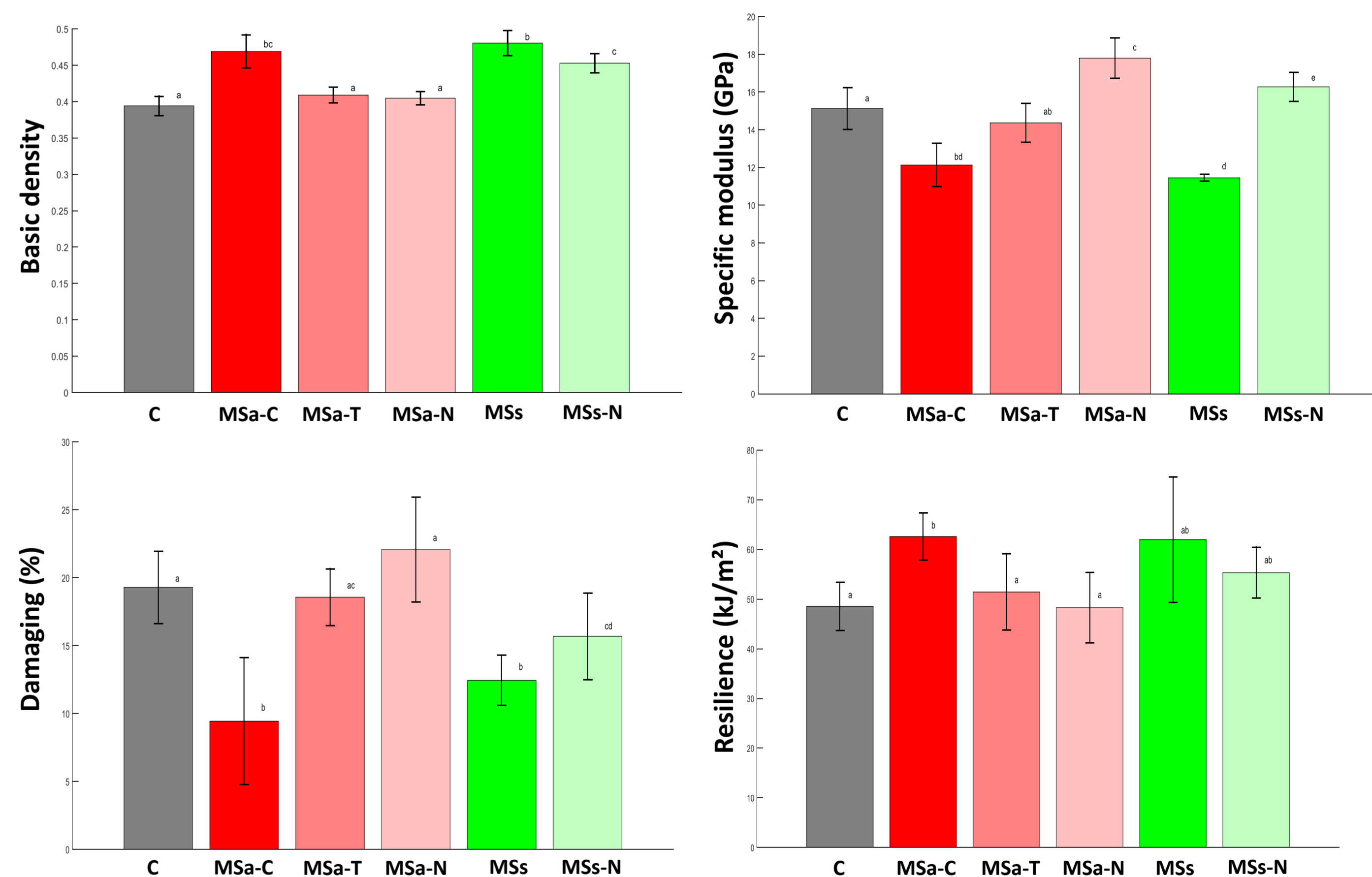
### Material and Methods

#### 3 points micro-bending test:



Control (C)	
MSa-C	-C: wood formed under Compressive stresses
MSa-T	-T: wood formed under Tensile stresses
MSa-N	-N: wood formed in the Neutral area
MSs	
MSs-N	

### Main results



### Main results:

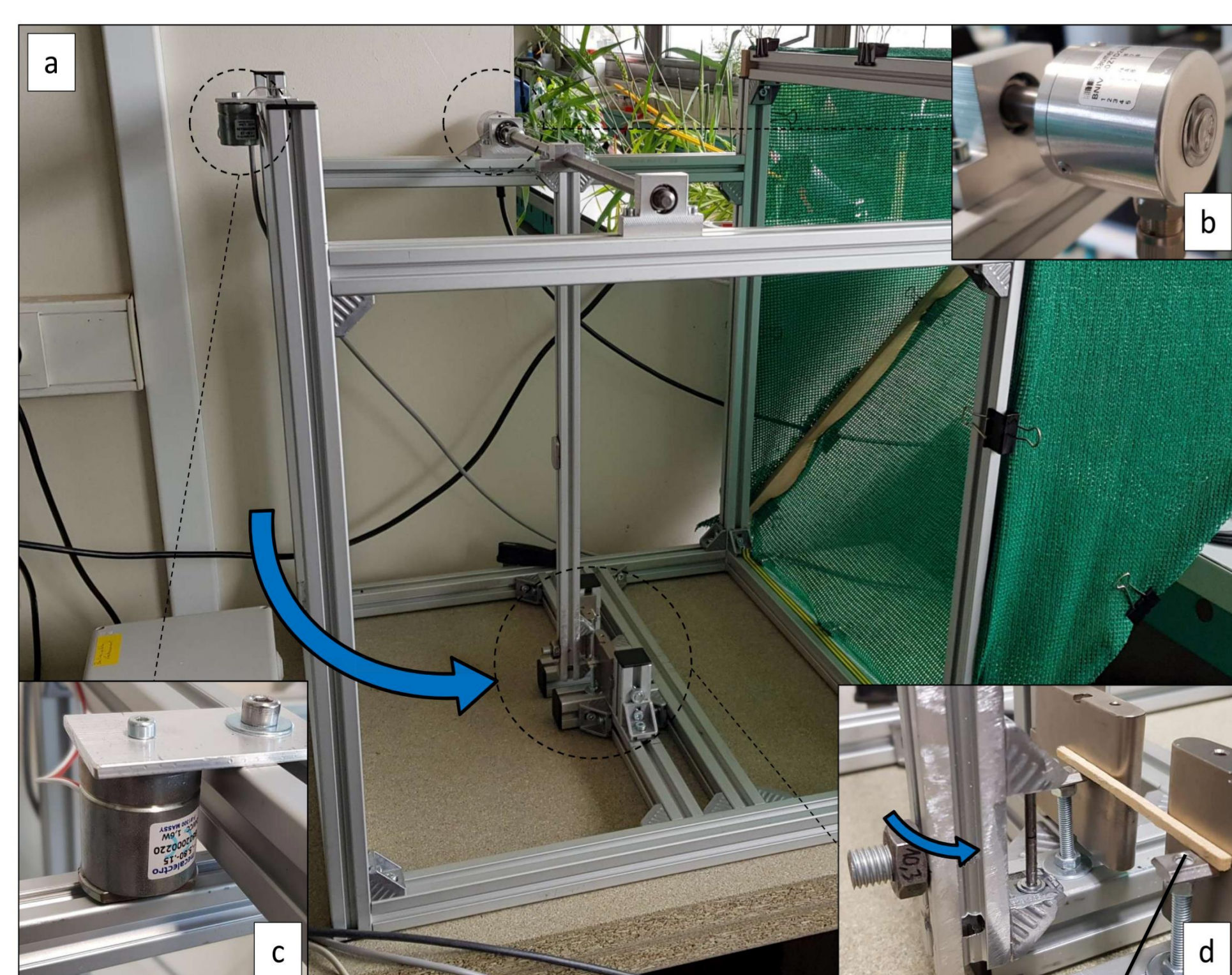
- **Increase of the basic density** of wood formed under compressive stresses MSa-C (**+19%**) and of "flexure wood" MSs (**+22%**) compared to control wood C.
- **Decrease of specific modulus** of wood formed under compressive stresses MSa-C (**-20%**) and of "flexure wood" MSs (**-24%**)
- **High decrease of damaging** for wood formed under compressive stresses MSa-C (**-51%**) and for "flexure wood" MSs (**-36%**)
- **Increase of mechanical resilience** of wood formed under compressive stresses (MSa-C) by **+29%**

### Key message:

=> **Compressive strains (risky strains for wood) drive the mechanical acclimation of wood to bending treatments**

=> **Wood acclimation to bending provides a mechanical benefit for trees sustainability in fluctuating mechanical environments**

#### Dynamic rupture (resilience):



Sample: 2x2x70 mm (RxTxL)