Drought resilience of interspecific hybrids of the tropical forest trees *Shorea leprosula* and *S. curtisii*

Climate change is predicted to increase drought frequency and intensity in the tropical rainforest regions of Southeast Asia, and there is concern that trees with low drought tolerance will die or grow poorly. The dipterocarp family, which dominates the forests of this region, is important as a timber resource. Among them, *Shorea leprosula* (Fig. 1) is suitable as plantation species due to its fast growth rate, but has the disadvantage of low drought tolerance. *S. curtisii*, on the other hand, grows slowly and takes longer to harvest, but can also be grown on dry ridges. An interspecific hybrid can combine the various characteristics of both parents and be used to create superior crop varieties. However, the characteristics of hybrids in dipterocarp trees are unknown. In this study, we investigated the leaf and branch characteristics associated with drought tolerance in interspecific hybrid seedlings between *S. leprosula* and *S. curtisii* to explore the potential for using hybrids to create varieties with high resilience to climate change.

First, we compared leaf morphology and physiological characteristics. *S. leprosula* had the thinnest leaves but also had the highest proportion of palisade layer with a higher photosynthetic capacity. On the other hand, *S. curtisii* had a thick cuticle and epidermis that protected the leaves from desiccation, but the proportion of the palisade layer was low. Hybrids had leaves with medium characteristics or almost the same as in the parent species (Fig. 2). The photosynthetic capacity of *S. leprosula* was higher than that of *S. curtisii*, consistent with its faster growth rate. The capacity of the hybrid was intermediate between the parental species and is likely to grow faster than *S. curtisii* (Table 1). Second, we compared the pattern in which branches lose their water-permeating function under drought stress, and *S. curtisii* and hybrids were found to be more drought-tolerant than *S. leprosula* (Fig. 3). Finally, we artificially dried the soil and examined changes in leaf drought tolerance. The lower leaf osmotic potential in hybrids and *S. curtisii* indicated that they had a greater ability for osmotic regulation under drought conditions than *S. leprosula*. When drought tolerance was assessed by leaf wilting point (water potential at loss of turgor pressure), the leaves of *S. leprosula* wilted easily, but the hybrids and *S. curtisii* did not wilt easily and had high drought tolerance (Table 1).

Overall, it was clear that the leaves and branches of the hybrid are more drought-tolerant than *S. leprosula*. This suggests that hybrids can be used to create varieties with high drought resilience, helping tropical forestry adapt to climate change.

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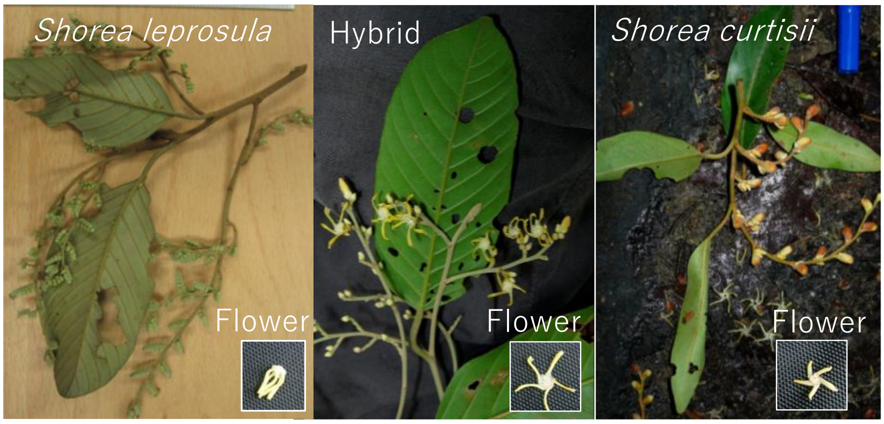

Fig. 1. Flowers and leaves of *S. leprosula* and *S. curtisii* and their hybrid
The petals of *S. leprosula* are closed and twisted, but those of *S. curtisii* are open. Hybrid flowers are open, but the petals are twisted, inheriting the characteristics of both parents.

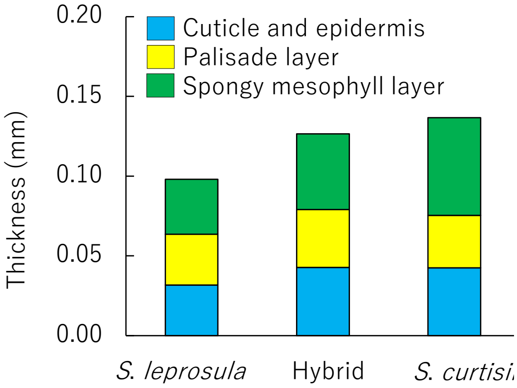

Fig. 2. Thickness of leaf internal tissue
Leaf surfaces with thick epidermis and cuticle significantly suppress water loss, making them more drought- tolerant, whereas those with thick palisade layers contribute to photosynthesis.

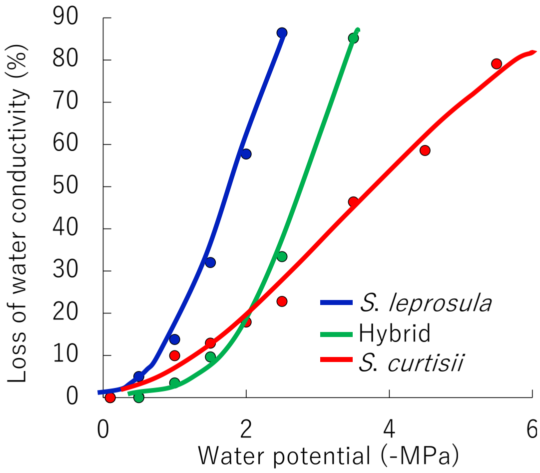

Fig. 3. Branch water conductivity under drought stress
A greater water potential means higher drought stress, which inhibits water flow in the branch. *S. leprosula* easily lost water conductivity under mild drought stress.

Table 1. Leaf photosynthetic rate, osmotic potential, and turgor loss point under drought stress

	Photosynthetic rate (μmol m^{-2} s^{-1})	Osmotic potential (MPa)	Turgor loss point (MPa)
S. leprosula	3.16a	-1.18a	-1.33a
Hybrid	2.44ab	-1.40b	-1.53b
S. curtisii	2.09b	-1.54b	-1.72c

Lower turgor loss point means that the leaves are more resistant to wilting and more drought-tolerant. Different alphabets indicate statistically significant differences.

Reference: Kenzo et al. (2023) *Forest Ecology and Management* 548: 121388.