Exploring morphogenetical gradient variability using hidden Markov tree models in young individuals of the tropical species *Symphonia globulifera* (Clusiaceae).

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In uneven-aged tropical rainforests, mechanisms of recruitment, *i.e.* the sustainable appearance of new individuals, rests on many mechanisms such as the phenology of flowering and dissemination, the survival of seedlings and their waiting capacities in the understorey (Oldeman, 1974). To understand how long young trees can survive in the understorey before reaching the canopy and with which morphological adaptations, a precise study of their morphology and their architecture is capital. Objectives of such descriptive approaches are (i) to identify the rules of plant construction; (ii) to apprehend their phenotypical plasticity in light stress conditions and their waiting capacities; (iii) to determine morphological markers that can inform about the development potential of the considered individual; and finally (iv) to provide information on the plant environment and its life-history directly integrated in the perennial structure of the tree.

The aim of this work is to characterize the phenotypical plasticity of young individuals of *Symphonia globulifera* L. f. (Clusiaceae), a species of South America and Africa tropical forests. A first set of data concerns 30 two-year-old individuals raised in a nursery in French Guyana under three different light treatments (5%, 10% and 20% of incident light). The morphological changes of the growth units (GUs) were explored using a hidden Markov tree model (HMT) that permits to identify homogeneous structures and their succession in a tree structure (Durand et al., 2005). For each GU, three variables were taken into account: the number of cataphylls, the number of leaves and the length. The estimated model permits us to identify seven well differentiated types of GUs. The HMT parameters allow these types to be interpreted as follows: the first one corresponds to the GU issued from germination; the second and third types characterize GUs issued from the branching process with a lower number of cataphylls; the 4 other types express a gradient of vigor characterized by an increasing length of the GUs and of their number of leaves. Considering transitions between these different GU types, we highlight various trajectories of tree development in relation to light environment. A second data set concerns 25 individuals of natural French Guyana forest growing up to 2m50 without knowledge about the age or the past growth of the trees. The structure of the trees was described and modelled according to the same protocol as the nursery trees. Comparison with the trees of the nursery enables us to make strong assumptions about the waiting capacities in understorey of this species and on the growth dynamics during time of the measured individuals.

In restricted light availability conditions, trees desynchronize and develop more GUs on the branches than on the trunk, thus forming a plate. The growth on the trunk occurs by elongation of very short GUs only, which are made up of one pair of cataphylls, a pair of leaves and one ultimate pair of cataphylls. Trees showing equivalent height and diameter can be constituted by a very different number of Gus, thus indicating a potentially very high difference in age, and consequently a great waiting potentiality in the understorey for this species.

References :

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