STUDY ON COMPETITION AMONG LATE-SUCCESSIONAL TREE SEEDLINGS ACROSS A TOPOGRAPHIC CATENA OF A SRI LANKAN RAIN FOREST

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ABSTRACT

Lowland rain forests of southwest Sri Lanka have a canopy stratum dominated by tree species from close taxonomic assemblages at the genus level. Forest associations have been identified within the forest topography from valley to ridgetop. The canopy tree genera in these associations have common silvical characteristics in reproduction and regeneration establishment. The most important silvical characteristic common to these tree species is the apparent site specialization. Recent studies suggested that species belonging to same genera have different adaptations in relation to dominating edaphic or hypsographic factors.

For this study, four *Shorea* species (*Shorea disticha* (Thw.) Ashton, *Shorea trapezifolia* (Thw.) Ashton, *Shorea megistophylla* Ashton, *Shorea worthingtonii* Ashton), one *Dipterocarpus* species (*Dipterocarpus zeylanicus* Thw.), two *Mesua* species (*Mesua nagassarium* Kosterm. and *Mesua ferrea* L.) and two species of *Syzygium* (*Syzygium makul* Gaertn., *Syzygium rubicundum* Wight and Arn.) were selected. All coexist in the rain forest of southwest Sri Lanka. Experiments were designed to investigate competitive outcomes of those species in different light and soil moisture regimes. Each plot was 2.4 x 2.4 meters and planting distance was 0.2 meters. Planted seedlings were monitored in gaps and understory condition across different topographic positions (low elevation, valley, midslope, ridgetop and high elevation) from year 1998 to 2003. On each site one plot was placed in a natural canopy gap and

another plot was located in the adjacent forest understorey. Light quantity was recorded on sunny days of every year, and soil moisture was measured twice a month. Soil analysis was done for Nitrogen, Phosphorus, Potassium, Calcium, Aluminium, and Magnesium in all canopy gaps and understory in all topographic positions. After one year of seedling growth and mortality were recorded. At the end of four years leaf nutrients analysis was done for N, P, K, Ca, Al, and Mg.

Photosynthetic photon flux density was gradually increased from valley to ridge in both gap and understory. Soil moisture was similar in both gap and understory conditions while it decreased from valley to ridge top. Soil nutrients did not show clear differences among microsites and among topographic positions.

Results demonstrated that the total daily amount of light received was the main factor determining competitive growth performance with secondary effects in the variation of soil moisture of topographic positions. All seedlings showed greatest mortality and relatively slow growth rate in all understory sites than gaps and mortality increased with elevation. The best growth of all species was observed in low elevation and midslope sites. All seedlings indicated a decline in growth performance and increased mortality with elevation.

Along with light and soil moisture gradient plant height growth, canopy expansion and foliar nutrient allocation provided the evidence to understand the competitive role played by species. *Shorea trapezifolia* and *Syzygium rubicundum* can be regarded as the most light demanding species with competitive superiors as judged by its height increment, leaf and branch increment, crown structure, root collar diameter and leaf nutrient allocation. At the other extreme are *Mesua ferrea* and *Shorea*

worthingtonii, which are the most shade tolerant and hence has the lowest competitive ability in the above group.

This study contributes to our understanding of canopy seedling responses to the influence of light, soil moisture, and soil nutrients in different topographic positions. Understanding this is critical towards the development of regeneration methods for the management of tropical lowland mixed species forest. Results of this study have facilitated the construction of a site classification system and light/drought tolerance indices for the important canopy trees within the forest. Further work is necessary to understand growth performance of these species and their niche specialization.

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