Abstract


This thesis has examined interactions of microsymbiont (bacteria and fungi) and macrosymbiont (Leucaena leucocephala and Newtonia buchananii) associations in relation to environmental disturbances. After 14 days' treatment, water stress lowered leaf water potential in all L. leucocephala seedlings, while inoculated and fertilised seedlings were more sensitive to water stress. The combined effect of water stress and applied fertilisers resulted in cessation of nitrogen fixation in L. leucocephala seedlings. Isolation and identification of wood inhibiting fungi in living N. buchananii revealed that the majority of the isolates has been reported as biocontrol fungi (Trichoderma 26%) and as endophytes (Amphispharea 16% and Fusarium 10%). Many of these endophytes occupied the living sapwood and adjacent sites. A new pathogenic Basidiomycete species, Phellinus newtoniae Niemelä & Mrema, living between the buttresses of Newtonia buchananii, is described. Other fungal pathogens on trees of economic importance were Nectria (13%) and Hypoxylon (2%). Pathogenicity tests showed that fungi caused cell death in N. buchananii and killed non-host seedlings (Scots pines) within 15 days after inoculation. The fungi caused damage to the endodermis and Casparian strips in roots, indicating that the water and nutrient pathway into the stele was not symplastic through the endodermis. It is suggested that both anatomical changes in nodules, together with damage to the endodermis and the observed stem cracks, are plant responses to internal biotic and abiotic stresses. Rough and rugose bark developed in 76% of N. buchananii trees growing in human disturbed forest, and only in 20% of those in undisturbed forests, probably due to temperature and humidity differences between the forest types. N. buchananii develops huge buttresses, which during their development inflict many open wounds and stem cracks on the tree. The buttresses extended to nearly 15 m from the trunk at the end, ramified and formed sinker roots. This additional root formation could be an adaptation to escape abiotic (nutrient depletion) and biotic (pathogen) stress and to compensate for root damage. It is concluded that low leaf water potential and bark pattern variations are indicators of abiotic stress. However, the process and possible function of open wound formation during buttress development is still unclear and requires further research.

Key words: buttress, butt rot, disturbance ecology, endophytes, fungi, Leucaena leucocephala, Newtonia buchananii, Phellinus newtoniae, stem cracks, symbiosis, tropical rainforest.