

Epiphytic bryophytes and habitat microclimate variation in lower montane rainforest, Peru.

by

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Declaration

This thesis contains no material which has been accepted for the award of any other degree or diploma in any tertiary institution, and to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference is made in the text of the thesis.

Signed

A handwritten signature in black ink, appearing to read "Jerry Romanski", written in a cursive style. The signature is positioned below the word "Signed" and above the printed name and date.

Jerry Romanski
18 November 2007

Abstract

A survey of epiphytic bryophytes and a study of microclimatic variation within a tree crown were conducted in lower montane rainforest at 2400 m in the Peruvian Yungas. A total of 129 species (87 hepatics, 1 hornwort and 41 mosses) were collected on 3 trees, using different methodologies. A single *Weinmannia* sp. host supported 110 species (77 hepatics, 1 hornwort and 32 mosses). Species with a wide distribution on the hosts made up 47% of the epiphytic assemblage, 22% were limited to the trunks and 31% occurred only in the crowns. The overall hepatic to moss ratio was 2.15:1. Mosses exhibited a narrower distributional range than hepatics. The greatest species richness and abundance was found on the large branches in the mid-crown. Species found in the mid-crown generally had a broader distribution on hosts than those found on the lower trunk or the outer crown. Classification and ordination analyses of the species and environmental data indicated the presence of 4 communities: an outer crown, a mid to mid-outer crown, an upper trunk and a lower trunk community. Species distribution on hosts in the present study appeared to be influenced by the intensity of radiation, particularly diffuse radiation, and relative humidity related to a moisture availability gradient. Temperature appeared least important. Six species were selected as potential microclimate change indicators.

Variation in temperature, relative humidity, visible sky fraction, leaf area index and radiation intensity were measured throughout a single canopy a co-dominant *Weinmannia* sp. The opposing gradients of temperature and relative humidity displayed similar fluctuation patterns as found in lowland rainforest, although the range of the gradients was smaller, possibly due to greater atmospheric mixing facilitated by the more permeable canopy at the montane rainforest study site. Microclimate stability decreased with distance above the ground. The lower trunk micro-habitat was the most humid, coolest and least illuminated. The highest temperature and lowest relative humidity were recorded in the mid-outer crown, closely followed by the most irradiated crown periphery. The above canopy temperature remained cooler during the day than the tree crown. The lowest mean hourly temperature was recorded in the mid-crown, induced by rapid

radiative cooling in the evening. The air above the canopy was warmer at night than any micro-habitat on the tree host.

The study found 27 bryophytes species (5 mosses, 22 hepatics) not previously recorded for Peru. Recommendations for methodology in future bryophyte surveys in Peruvian lower montane rainforest are presented. Future studies must parallel more concerted efforts to raise the awareness of the local population about the ecological importance of bryophytes, particularly in cloud forests.

Resumen

Un estudio de briofitas epifitas y de la variación microclimática dentro de la copa de un árbol fueron conducidos en los bosques mas bajos de montaña a 2400 m. en las Yungas peruanas. Un total de 129 especies (87 hepáticas, 1 antocerota y 41 musgos) fueron recolectadas en 3 árboles, usando diferentes metodologías. En un solo *Weinmannia* sp. se encontró 110 especies (77 hepáticas, 1 antocerota y 32 musgos). Especies con una amplia distribución en los árboles contribuyeron 47% de epifitas, 22% fueron limitados a los troncos y 31% ocurrieron solo en las copas. La totalidad de tasa de hepáticas a musgos fue 2.15:1. Los musgos mostraron un rango de distribución mas estrecho que las hepáticas. La más grande riqueza y abundancia de especies fue encontrada en las ramas grandes de la media copa. Las especies encontradas en la media copa generalmente tuvieron una distribución mas ancha en los árboles que aquellos encontrados en el tronco bajo o en la copa exterior. Los análisis de clasificación y ordenación de las especies y data de medio ambiente indicaron la presencia de 4 comunidades: Copa exterior, de media copa a media copa exterior, parte superior del tronco y la comunidad de la parte baja del tronco. La distribución en los árboles del presente estudio pareció ser influenciada por la intensidad de radiación, particularmente radiación difusa y relativa humedad relacionada a la escala de disponibilidad de agua. La temperatura pareció menos importante. Seis especies fueron seleccionadas como indicadores potenciales del cambio de microclima.

La variación de la temperatura, humedad relativa, fracción visible de cielo, índice de la área foliar e intensidad de radiación fueron medidos en todas partes de un co-dominante *Weinmannia* sp. Las escalas opuestas de temperatura y humedad relativa mostraron similar fluctuación como los encontrados en Selva Baja; sin embargo, el rango de las escalas fue más pequeño, posiblemente a causa de mejor combinación atmosférica facilitada por el dosel más abierto en bosque de montaña elegido para el presente estudio. La estabilidad microclimática disminuyó con la distancia del suelo. El micro hábitat en la parte baja del tronco fue el más húmedo, más fresco y menos iluminado. La temperatura más alta y humedad relativa más baja fueron registradas en la media copa exterior, cercanamente seguido por la periferia de la copa más irradiada. La temperatura sobre el dosel permaneció más fresco durante el día que la misma copa del árbol. El promedio de horario de la temperatura más bajo fue registrado en la media copa, causado por el rápido enfriamiento radiativo en la noche. El aire sobre el dosel fue más caliente en la noche como en cualquier micro-hábitat en el árbol.

En el estudio se encontró 27 especies de briofitas (5 musgos, 22 hepáticas) que no eran citados en el Perú. Las recomendaciones para metodología en estudios futuros de briofitas en los bosques de montaña baja peruana, son incluidas en el presente informe. Futuros estudios deben suceder paralelos a los esfuerzos concertados para la concientización de la población sobre la importancia ecológica de las briofitas, particularmente en los bosques nublados.

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