Detritus collection in wastebasket plants (*Asterogyne martiana*)

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Abstract: Asterogyne martiana is a dominant understory palm at La Selva Biological Station, Costa Rica. This "wastebasket plant" captures leaf litter in its crown. Decomposition and mineralization of organic matter in the crown may enrich stem flow running to the base of the plant. We hypothesized that leaf litter collection by *A. martiana* would increase dissolved organic matter in stem flow. Our results support our hypothesis and suggest that *A. martiana*'s ability to collect detritus increases nutrient supply to the roots.

Key Words: decomposition, nitrogen, nutrient cycling

Introduction

Understory plants at La Selva Biological Station, Costa Rica, intercept and retain substantial amounts of leaf litter (Parker 1994). Palm genera such as *Geonoma*, *Quararibea*, and *Asterogyne* are common litter-collecting plants in La Selva. *Asterogyne martiana*, a small understory palm, captures leaf litter in its crown. Raich (1983) suggests that the litter trapping habit of *A. martiana* contributes to its success in the forest understory.

We hypothesized that detritus collection by *A. martiana* would increase the level of dissolved organic matter (DOM) in the stem flow. We predicted that stem flow would be higher in DOM when collected from trees containing detritus than when collected from trees from which detritus had been removed. Finally, we predicted that, across trees, detrital mass would be positively correlated with DOM in stem flow collected before detritus removal.

Methods

We collected stem flow from five *A. martiana* trees at La Selva Biological Station, Costa Rica on 15 February 2003. We recorded maximum leaf width and tree height (measured from ground to base of the apical leaves) for each tree sampled (n = 5). We poured tap water on the plant so that water ran over the leaf, through the detritus held by the leaf bases, and down the stem. We collected 100 ml of resultant stem flow from the base of each plant after it had passed through the detritus. Then we removed all detrital matter manually and weighed it using an electronic balance. After detritus removal, we used tap water to remove all detrital residues, then used the procedure outlined above to collect stem flow again. To obtain an index of DOM in stemflow, we poured the collected water into plastic cuvettes (n=3 for each before and after treatment) and measured the absorbance value at 440 nm using a spectrometer. We assume that absorbance values are proportional to DOM concentrations.

Results

Absorbance differed significantly before and after detritus removal, with respective mean values (± SE) of 0.05 ± 0.005 and 0.003 ± 0.004 (Fig. 1; paired-t = 5.63, df = 14, P > 0.001). Absorbance by stem flow before detritus removal was positively correlated (with marginal significance) to the mass of detritus held by a plant (Rho = 0.47, P = 0.08). We found no significant correlation between detrital mass and tree height or leaf canopy spread. In the organic matter removed, we observed fine organic matter in an advanced state of decomposition.

Discussion

Detrital accumulation in *A. martiana* increases absorbance in stemflow, which we interpret as an increase in DOM. This DOM may increase nutrient availability to the roots at the base of the stem. Rainwater passing through the detritus collected in *A. martiana's* crown should similarly increase nutrient supply for tree growth. Invertebrates present in the detrital matter probably help to break down coarse litter into finer particles, increasing the surface area available to microorganisms that convert it to inorganic (soluble) forms. Microorganisms and litter decomposition in the soil further mineralize DOM carried from the bracts to the base of the plant. Litter collection in the understory may benefit plants in tropical habitats with shallow soil and low available nutrients.

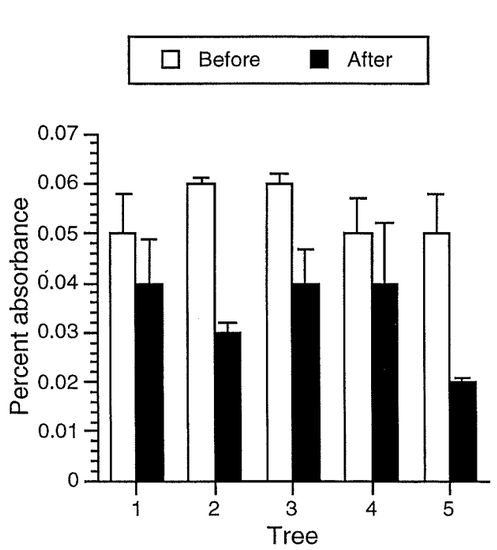

FIG. 1. Percent absorbanc(mean ± SE) interpreted as concentratration of dissolved organic matter in stem flow before and after detritus removal from *Asterogyne* palms in La Selva Biological Reserve, Heredia Province, Costa Rica. (n = 3 measurements per tree).

Literature Cited

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* Authors' note: We attempted to run nitrogen digestions and derive a standard curve using a combination of the persulfate and the nitrate methods. We warn future researchers that although the La Selva staff was gracious and eager to help, lack of specific laboratory equipment (particularly quartz cuvettes) limited our ability to accurately measure nitrogen in water samples.