

研究论文

南方红壤区杜仲 (*Eucommia ulmoides*) 树干液流动态

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摘要 采用根据热平衡原理设计的热扩散探针 (Thermal dissipation sap flow velocity probe, TDP), 于2004年7月到10月对南方红壤区的杜仲人工林的树干液流进行连续监测, 结合所测定的相关因子, 分析杜仲液流的变化规律及其与各因子的关系。结果表明, 在不同月份, 杜仲液流速率的日变化规律基本一致, 呈单峰曲线, 但是树干液流在启动时间、峰值出现时间上存在差异; 从7月到10月份, 杜仲树干液流速率逐渐增大, 10月份液流速率达到1.818 g/(cm²·h); 杜仲液流速率与太阳辐射、空气相对湿度、温度、风速等气象因子相关性显著, 但是太阳辐射和空气相对湿度是影响杜仲液流的重要因子, 其中7月到9月份, 太阳辐射是主要影响因子, 而10月份, 空气相对湿度占主导地位; 树干液流与胸径、冠层厚度以及胸径平方与树高之积呈现出显著的相关性。

关键词 [树干液流](#); [热扩散法](#); [杜仲](#); [红壤区](#)

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Dynamics of stem sap flow velocity of *Eucommia ulmoides* in red soil region, Southern China

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Abstract *Eucommia ulmoides* is a tree species commonly used for reforestation in Southern China. It is known to play an important role in water conservation, but the effects of tree structural and environmental factors on the transpiration and water balance of this species have not been fully studied. The aim of this study was to evaluate the diurnal and monthly variability of stem sap flow velocity in *E. ulmoides*, as well as to understand how structural features and environmental factors were potentially controlling the whole-plant water-use of the species. The study was conducted from July to October in 2004 at the Ecological Benefit Monitoring Station of the Yangtze River Protection Forest in Cili County, Hunan Province (29°30'N, 110°10'E). Stem sap flow velocity was measured using a thermal dissipation probe (TDP, Dynamax, Houston TX, U.S.A). With this probe, data were recorded automatically every 10 minutes. During the same time period, several environmental variables (i.e., mainly meteorological observations) were measured every 5 minutes at a weather station located within the study area. From July to October, stem sap flow velocity of *E. ulmoides* increased monotonically, reaching maximum values (i.e., 1.818 g/(cm²·h) during October. Diurnal variation of stem sap flow velocity was similar among the different months studied, exhibiting a unimodal pattern that resembled the ones observed for air temperature (*T*) and solar radiation (*RAD*). However, there are differences in sap flow starting time and peak time among different months. Stem sap flow velocity was significantly related with solar radiation (*RAD*), relative humidity (*RH*), air temperature (*T*), and wind speed (*WS*). Among these, *RAD* and *RH* seemed to be the most important factors, as was indicated by their high partial correlation coefficients. *RAD* was the most important factor from July to September, while *RH* was the most important factor in October. Stem sap flow velocity of *E. ulmoides* also showed significant correlations with structural characteristics of the forest such as diameter at breast height (*DBH*), canopy height (*H* canopy), and their interaction of (*DBH*)² and tree height (*H*) (i.e., (*DBH*)²*H*).

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Key words [stem sap flow](#); [thermal dissipation probe](#); [Eucommia ulmoides](#); [red soil region](#)

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