WATER, WATER EVERYWHERE, BUT...:

TISSUE WATER RELATIONS OF BOG AND RAINFOREST PLANTS

OF ALAKAI SWAMP, KAUAI[1]

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It has been suggested that bogs are a physiologically droughty habitat for plants, despite the abundance of water found there. This research addresses that paradox and one way in which bog plants cope with it. Functional responses of two pairs of endemic Hawaiian plant taxa from montane bogs were compared to help explain their differential distributions. Metrosideros polymorpha var. incana[2] is nearly limited to open bogs; M. p. var. glabrifolia is largely limited to the surrounding rainforest. Dubautia paleata is largely limited to open bogs, while D. raillardioides is restricted entirely to the rainforest.

Tissue water status was determined by field measurement of diurnal water potential, using a pressure chamber. The midday water potential of plants growing in the bog is more negative than that of the same taxon growing in the rainforest. Plants growing in the bog therefore have greater internal water deficits than those growing in the rainforest (i.e., bog plants exhibit some degree of "physiological drought").

Pressure-volume curves indicate that tissue osmotic potential at full turgor is more negative in taxa typically limited to bogs than in taxa limited to the rainforest. Lower osmotic potential at full turgor reflects greater maximum turgor. Since many physiological processes are known to depend closely on tissue turgor pressure, the osmotic properties of the bog taxa (M. p. var. incana and D. paleata) should promote their growth in the bog habitat. Properties of tissue water relations thus may contribute to the development and maintenance of the distinctive flora of Hawaiian bogs.

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[2]Epithets of Metrosideros used provisionally.