

POISON-IVY: RELATIONSHIPS WITH
THE WEIGHT AND MOISTURE CONTENT OF THE LITTER LAYER

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Abstract

The abundance of Rhus radicans at a bottomland site of the Pine Hills Field Station was determined to be greatest where the dry weight of the accumulations in the litter and fermentation layers is least. A significant correlation exists; however, the relationship between abundance of poison-ivy and average moisture content of the detritus layer was statistically insignificant.

As part of a comprehensive study of the microclimates at the Pine Hills Field Station of Southern Illinois University, data were collected which permit an analysis of the relationship of the dry weight and moisture content of the litter layers with the abundance of poison-ivy (Rhus radicans L.). The specific site was located immediately west of an oxbow lake (Otter Pond) on the Mississippi floodplain (37° 32' 50" N, 89° 25' 55" W). Ashby and Kelting (1964) have described a similar site which they classified as a mature sweetgum community, typical of lowland and major ravine locations.

During the summer months Rhus radicans is the most abundant species in the herbaceous layer at this site, however the distribution and abundance is highly erratic. This pattern is assumed not to be controlled by fire. Observations verified the conclusions of Ashby and Kelting (1964) that this forest has not burned for at least 40 years. Preliminary observations indicated no obvious relationship of poison-ivy distribution with light penetration. Precipitation through-fall to the forest floor also proved inconclusive. Twenty rain gages were randomly placed on the forest floor covering an area of approximately 300 m². Through-fall for several rainshowers was observed and some tendency was noted for through-fall to be higher for gages placed by chance in patches of poison-ivy. However, there was much variance and the difference between through-fall for gages in and outside of poison-ivy patches was statistically insignificant. Consequently measures of the litter layer promised improved explanation of poison-ivy distribution and abundance, and an existing experiment was redesigned to include observations of poison-ivy occurrence.

Beginning on 15 May 1970 and ending 8 September 1970, 78 samples of the litter and fermentation layers (A_{00} and A_{02}) were collected using random sampling techniques. A wooden frame, 0.209 m in area, was used as an outline of the area to be sampled. Presence of poison ivy was recorded when one or more leaflets appeared in the quadrat. All litter except for twigs and branches larger than 0.25 inch (0.64 cm) in diameter was collected down to but not including the mineral soil. Samples were bagged and oven-dried at 105°C for 12 hours. The moisture content of each sample was determined in the customary manner to be the ratio of the difference between the wet and dry weight over the dry weight.

The most obvious conclusion which may be drawn from this experiment is that the mean dry weight of the litter layers is consistently less under areas where poison-ivy is located (Table 1). This generalization is true in the early as well as the late summer. And, it is noteworthy that the proportion of samples which recorded occurrence increased during the course of the summer. As expected the standard deviations of the sample weights were large, especially for the nonoccurrence samples where weights in excess of 1600 grams/m² were observed. For the entire season's samples the difference between the means of the occurrence and nonoccurrence samples was 216 grams/m².

Table 1. The means, standard deviations, and sample size for the dry weight and moisture content of the litter layers. Occurrence and nonoccurrence refer to whether or not Rhus radicans was observed in a sample plot.

OVEN DRY WEIGHT (grams/m ²)						
	Occurrence			Nonoccurrence		
	M	S.D.	N	M	S.D.	N
Early Summer (May, June)	879.0	136.0	11	1130.7	313.9	17
Late Summer July-Aug-Sept)	840.8	216.7	28	1019.0	230.2	22
Full-Season	851.6	198.1	39	1067.7	269.7	39
MOISTURE CONTENT						
Full-Season	57%	38.8	39	71%	46.1	39

A corollary of the oven dry weight is the moisture content because one would expect the heavier samples to retain greater amounts of moisture. Table 1 shows that the variance is again large with standard deviations of 38.8 and 46.1 for the respective moisture percentages for occurrence and nonoccurrence. The full-season difference in mean moisture percentage, 57% versus 71% is not significant at 0.05. Consequently the effect of litter moisture is uncertain and substantially masked by litter weight, however a few of the nonoccurrence samples were water-logged. Yet during the driest spells recorded, moisture content of the nonoccurrence samples were consistently lower in moisture than the samples with occurrence. It is probably safe then to conclude that at this site, at the time of experimentation, that litter moisture did not indicate occurrence and certainly did not substantially regulate the abundance of poison-ivy.

In order to examine the degree of relationship of litter weight and moisture with the abundance of poison-ivy, the biserial coefficient of correlation (r_b) was determined and is presented in Table 2. The r_b coefficient is appropriate when either of the correlated variables can be measured on a continuous scale but one variable because of various constraints must be

reduced to two categories (Guilford, 1965). In this case, the abundance of poison-ivy on the forest floor, a continuous variable, was dichotomized into samples which had occurrence and nonoccurrence. Correlations are modest at best; however all correlations between abundance and litter dry weight are significant at 0.05. As a predictor variable litter weight would account for only about 20 percent of the variance in abundance. The coefficient between moisture and abundance ($r_b = -0.194$) is barely insignificant.

Table 2. Biserial coefficients of correlation (r_b) between litter dry weight and the abundance of Rhus radicans, and, between litter moisture and abundance.

	r_b , weight and abundance	r_b , moisture and abundance
Early Summer	-0.512	---
Late Summer	-0.463	---
Full-Season	-0.455	-0.194*

*not significant at 0.05

Clearly, additional measures of the poison-ivy habitat are required to explain its patterns. However, as the extensive review of Gillis (1971) indicates, very little of a quantitative nature is known about poison-ivy. From the observations presented we see that poison-ivy is less abundant on sites with thick litter and water-logged sites. Poison-ivy tends to favor sites where apparently decomposition rates are higher resulting in a thin litter layer. Consequently there may be a tendency for poison-ivy to invade a larger area during the summer in response to the reduction of litter by decay.

Finally, yet perhaps most significant of the conclusions which may be gleaned from this study is the following. When one of the numerous experiments which require samples of forest litter is designed, it is clear that in spite of the toxic effects of poison-ivy, that all areas should be sampled. To do otherwise would seriously bias many measures of the forest litter system.

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