THE ECOLOGY OF RHUS TOXICODENDRON

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It was suggested that more information was needed on the variations in individual species in relation to their environments. Rhus Toxicodendron was selected for study, not because of its poison character, but because it is a species which has a wide distribution, being found, as you know, in all situations from the very dry to the very wet. Field studies were made in eight typical locations during July, August, and September of last year, 1921. Measurements were made from 75 or more leaves in each location, being careful to consider only leaves which were mature and to consider all conditions of the fully developed leaves. From these measurements the average size was calculated. All further study was made from the average leaves. For convenience the lots have been lettered A, B, C, D, E, F, G, H.

When the leaves were arranged in a descending series, beginning with the most mesophytic, it was noticed that they could be divided into four groups. Only one lot of each of the groups will be considered today, by figures B, D, F, and G.

The leaves of lot B are from a moist dune environment, located at Wycliff, Ind. The soil, of course, was sandy. The pocket was quite deep so that the bottom of it must have been near the level of the lake. From the other plants growing in the same location the degree of mesophytism can be seen. The more prominent ones were:

Acer saccharum
Tilia americana
Quercus Alba
Pinus Strobus
Hammamelis
Psedera
Fragaria

The leaves from which measurements were made were growing on the side of a dune very near the bottom in the shade of the maple trees.

The leaves of lot D are from a flood plain of the Desplaines river at Riverside, Ill. The plot was about fifteen feet from the river and the soil was quite moist. Other species growing in the same situation were:

Quercus macrocarpa
Acer saccharinum
Juglans nigra
Tilia americana
Ulmus americana
Ambrosia trifida
Crataegus
Panicum

The leaves from which measurements were made were growing in the shade of an elm tree.

Lot E was located at the top of a dune at Mineral Springs, Ind., a xerophytic dune environment. The other species in the same environment were:

Juniperus communis
Cornus stolonifera
Rhus aromatica
Vitus vulpina

The plants were growing on bare sand, but were more or less shaded.

Lot G was located on a sandy level beside the tracks at Smith, Ind. The soil, though sandy, had more humus than either of the other dune locations. The other species found there were:

Populus deltoides
Plantago
Fragaria
Salix (nigra)
Grasses
Compositae

The situation seemed very xerophytic and the plants were not as shaded as in the other three locations.

From some of the leaves collected in the different plots, blue prints were made in order to determine the

areas. The area in square centimeters of the end leaflets from these four representative plots were:

Lot B, 63
Lot D, 36
Lot F, 17
Lot G, 12

These areas, as you see, conform with the types of their environments.

This has not proven true for the thickness of the leaves. When sections were made and measured, there seemed to be almost no relation between xerophytism and the thickness of the leaf. In the diagram, the leaf sections were arranged in the same order as the leaf areas in the preceding diagram. As you can see, the mesophytic leaves may be as thick as the xerophytic, or even thicker in some instances.

The last and most important contrast is in the microscopic study of the sections. Though it seems impossible to tell by the thickness of the leaves whether they are mesophytic or xerophytic—when the general compactness of the tissue is considered, the difference is very striking. Cross sections were drawn on graph paper in order to determine the relation between the total area of the leaf section and the part of that area occupied by cells. In this way a coefficient of compactness could be determined. This work is not yet finished and I am not ready to give a conclusive statement, but so far as this has been considered the coefficient of compactness is:

Lot B, 61
Lot D, 74
Lot F, 87
Lot G, 89

This conforms with the leaf area and type of environment.

Considering the individual elements, as seen in the cross section of the leaf, the greatest variation is in the upper epidermis and the spongy tissue. The variations in the upper epidermis are marked, the epidermis being much thicker when the leaves were growing in xerophytic regions. Some species of plants have variation in the number of the rows of palisade cells when growing in

different environments. In the case of Rhus Toxicodendron there is not this contrast. In almost no case is there more than one layer of palisade cells. Nor is there any marked difference in the thickness of the one layer of cells. In the spongy tissue there is variation, not in the thickness, but in the restriction of the amount of air spaces. This, of course, is what causes the variation in the coefficient of compactness.

In conclusion, The variations in the structure of the leaves may be summed up in the following:

1. The leaves are greater in area where the situation is mesophytic and smaller in the xerophytic locations.
2. There is no apparent agreement in the relation between leaf area and leaf thickness. This is contrary to the usual condition.
3. There is agreement between the compactness of the leaf and its environment.