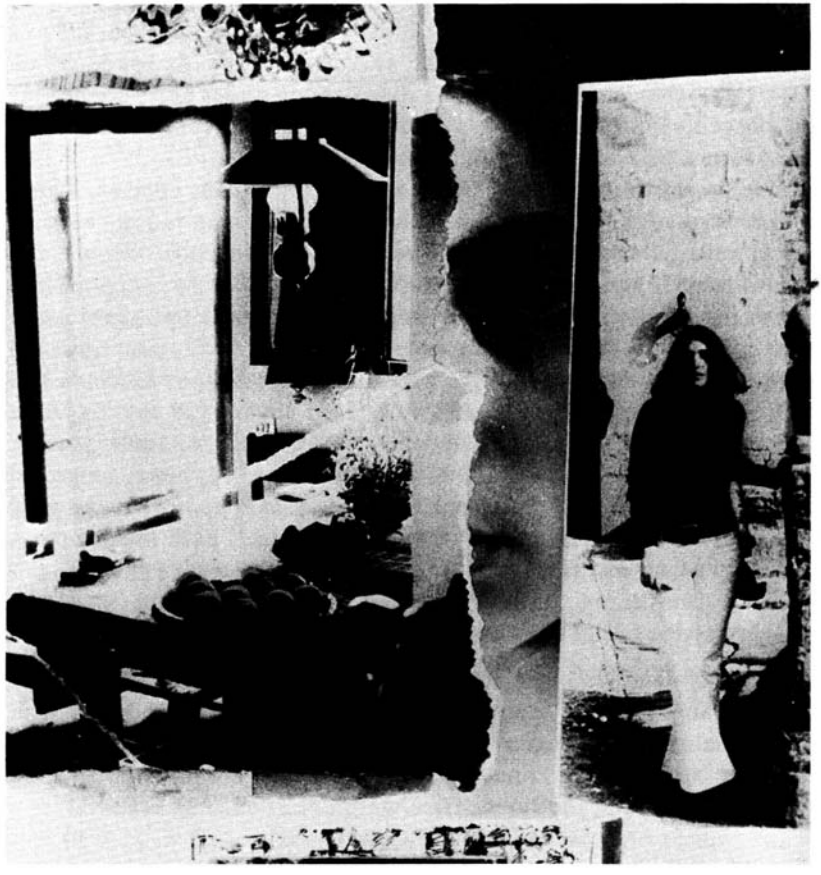
MICHIGAN ACADEMICIAN

PAPERS OF THE MICHIGAN ACADEMY OF SCIENCE, ARTS, AND LETTERS



VOLUME XII FALL 1979 NUMBER 2

A Biometric Analysis of Lenticel Development in Red-Osier Dogwood (*Cornus stolonifera* Michx.) in Relation to Soil Moisture Content

DONALD H. LES AND MARK A. MILLER
Eastern Michigan University

The red-osier dogwood (*Cornus stolonifera* Michx.) is a shrub capable of colonizing a wide range of habitats. It is found in wet lowlands or swamp margins but can also endure the dessicating conditions of dunes (Downing, 1922). This ability of the species to survive extremes in soil moisture content necessitates the presence of an adaptive mechanism which inhibits dehydration under xeric conditions and prevents root anaerobiosis under semiaquatic conditions (when water-saturated soils are devoid of oxygen).

Adaptations to inundation are known in other plant species. These include formation of water roots and anaerobic respiration, both of which contribute to oxidation of the rhizosphere (Hook, Brown and Wetmore, 1972). The ability of a plant to translocate oxygen from the aerial mass to the root is also important for survival under prolonged anoxic soil conditions (Hook, Brown and Wetmore, 1972, Hook, Brown and Kormanik, 1971). Although the aerating function of lenticels had been suggested by Wetmore (1926), Sifton (1945) and Esau (1960), it has been clearly demonstrated that leaves and lenticels provide two major pathways through which atmospheric oxygen is supplied to the roots of woody plants (Chirkova, 1968, Hook, Brown and Kormanik, 1970). In deciduous shrubs, the lenticel pathway becomes extremely important for survival through winter

Methods

The field data were collected at one location which contained a gradient ranging from saturated to well-drained soils, and in which the population of red-osier dogwood was abundant. We delineated into three zones. Each zone was characterized by a different degree of soil moisture and the boundaries were determined as follows.

Zone I. Soils overlain by an average of 10 cm of standing water and supporting typical "wetland" species

Zone II. Saturated soils but without standing water; vegetation

composed of a "fringe" of "amphibious" shrubs around the first zone

Zone III. Well-drained soils supporting typical upland species

Seven red-osier dogwood plants from each zone (i.e., 21 plants) were randomly selected for inclusion in the analysis. On each plant six branches were counted for the number of lenticels. Only the last three internodes of each twig were counted. Length of each internode was measured and the number of lenticels at each internode counted. From these data the mean number of lenticels per internode was used in constructing paired t-test comparisons of the three zones. Paired comparisons between zones I and III, I and II, and II and III yielded t values of 3 7, 0.5, and 4.9, respectively ($n = 42$). A statistical difference of P less than 0.001 occurred between zones I and III, and between zones II and III. The P for zones I and II was greater than 0.5 The minimum and maximum mean number of lenticels per internode produced in zones I, II, and III were 6 and 50, 7 and 37, and 2 and 21, respectively

Results and Discussion

The results of this study statistically show a larger mean number of lenticels per internode was produced in a population of red-osier dogwood when growing in wet soils than when growing in well-drained soils. This statistical difference supports the presumption that an adaptive mechanism of lenticel development control exists in this species and is influenced by the degree of soil moisture in which the plant grows. A statistical difference did not occur between plants growing on saturated soils and those growing in standing water, suggesting that complete inundation is not a prerequisite for lenticel proliferation in this species. Whether or not the saturated state of soil is the sole factor involved in initiating the response is not known. The age of lenticels must be considered since it has been shown (in the instance of potato tubers) that lenticels can become dormant in older growth (Adams, 1974). In this study the influence of lenticel senescence was kept at a minimum by counting only the last three internodes of each twig.

REFERENCES

ADAMS, M. J 1975 Potato Tuber Lenticels. Development and Structure. Ann. of Applied Biology 79:265–273.

CHIRKOVA, T V 1968. Oxygen Supply to Roots of Certain Woody Plants Kept Under Anaerobic Conditions. Soviet Plant Physiology 15(3):475–477

DOWNING, E. R. 1922. A Naturalist in the Great Lakes Region. University of Chicago Press, Chicago. 328 pp.

ESAU, K. 1960. Anatomy of Seed Plants. John Wiley & Sons, Inc., New York. 376 pp.

HOOK, D. D , C. L. BROWN AND P P KORMANIK. 1970. Lenticel and Water Root Development of Swamp Tupelo Under Various Flooding Conditions. Bot. Gazette. 131(3):217–224.

———, C. L. BROWN, AND P P KORMANIK. 1971 Inductive Flood Tolerence in Swamp Tupelo (*Nyssa sylvatica* var biflora [Walt.] Sarg.). J Exp. Bot. 22(70): 78–89

———, ———, AND R. H. WETMORE. 1972. Aeration in Trees. Bot. Gazette. 133(4):443–454.

SIFTON, H. B 1945 Air-Space Tissue in Plants. Bot. Rev 11 108–143

WETMORE, R. H. 1926. Organization and Significance of Lenticels in Dicotyledons. Bot. Gazette. 82(2):113–131