Lichens On Galápagos Giant Tortoises

Abstract. *The association of* Physcia picta *with the giant Galápagos tortoise is believed to be the first reported occurrence of lichens on land animals. The habitat is restricted to specific sites on the carapace of male tortoises.*

The giant land tortoise, *Geochelone elephantopus* (Harlan) has been found to serve as a host for the lichen, *Physcia picta* (Sw.) Nyl. Tortoises with epizoic colonies of lichens were discovered in February 1964, in the interior of western Santa Cruz (Indefatigable) Island by a field party of the Galápagos International Scientific Project. The occurrence is noteworthy because it represents possibly the first recorded instance of a lichen growing on a living land animal. *Physcia picta* is one of the most ubiquitous of Galápagos lichens, growing on many different substrates, including lava rock, dry wood, bark of living trees, and evergreen leaves.

The potential area for lichen colonization is restricted by the habits of the tortoise. The lower part of the carapace is unavailable because of the fact that the tortoises spend long periods of time partially submerged in shallow freshwater pools when these are (seasonally) available. The front, top, and sides are unavailable because the animal is constantly pushing its way through dense underbrush, thereby scouring the carapace. This leaves only a small crescent-shaped area on the upper rear of the carapace which is not vulnerable to one or the other deterrent to colonization; upon this area the lichens were found. Only males are so colonized; in the case of females the area in question is heavily abraded by ventral surfaces of males attempting copulation.

Fragments of the outer, horny layer of the carapace were removed with the attached lichens and are preserved in the lichen herbarium of the University of Colorado Museum.

JOHN R. HENDRICKSON
University of Hawaii, Honolulu
WILLIAM A. WEBER
University of Colorado, Boulder

1 June 1964

Osmotic Stress: Effects of Its Application to a Portion of Wheat Root Systems

Abstract. *Application of a slight osmotic stress to only a portion of young wheat roots significantly affected certain metabolic fractions throughout the entire plant. These components change rapidly with time and therefore time studies must be used in experiments of this type concerned with an evaluation of changes in metabolic fractions in plants that are induced by environmental factors.*

Studies of moisture stress on plants are often confounded with an insufficient definition of conditions. Whether nutrient uptake is affected by soil-moisture tension per se or only through its indirect effects on soil characteristics has been of interest to, and of some controversy among, soil scientists and plant physiologists. Mederski and Wilson (*1*) used a split-root technique in which the top portion of corn roots developed in sand culture while the remaining portion developed in soil adjusted to known moisture contents in the range of wilting point to field capacity. The readily available water in the sand compartment and the high humidity of the atmosphere precluded the development of a growth-limiting water stress in the plant tops. The results of their technique—decreased growth with increasing stress—must have been due to reduced uptake of ions or translocation of ions rather than to a loss of turgescence in the tissue with subsequent effect on physiological processes. They indicated that soil factors relating to moisture films might be the regulating influence on ion uptake.

Our study was conducted with solution cultures, and thus precluded soil factors that reduce uptake of ions. Similar results were obtained with an osmotic stress in the presence of ample nutrients and water. Alterations in the physiology of the root are probably responsible for the reduced concentrations of phosphorus, substantiating the conclusions of Dean and Gledhill (*2*).

Nine-day-old wheat plants, with their roots initially trimmed to two roots, were grown in a divided container so that each root could be placed under separate treatment. Osmotic solutions of "Carbowax 6000" (*3*) in nutrient solutions were used as stress treatments. Plants were harvested 24, 48, 96, and 120 hours after treatment.

The conditions maintained were a temperature of 18°C, a 16-hour light period with an intensity of approximately 3.3 lu/cm^2, and 55 to 65 percent relative humidity. These conditions indicate a low evaporative demand and should preclude internal water deficits being set up in the plant because of limited water movement.

All results are reported on plants with one root in nutrient solution and the other in an osmotic solution at a pressure of 1 bar. The control had both roots in nutrient solution.

Relative turgidity measurements indicated no difference between the control and those plants with one root under 1-bar stress. Tops of the stressed plants did not have a significantly higher percentage of dry matter than control plants until 120 hours after application of the stress. The stressed root had a significantly higher percentage of dry matter than either the nonstressed root of the same plant or the roots of the control plants at all harvests. The nitrogen content of the plant tops, with a root under stress, was not significantly different from the control throughout the experiment. The stressed root had a significantly lower nitrogen content than the control roots, whereas, the nonstressed root had the same nitrogen content as the control. This would indicate a decreased uptake of nitrogen. The phosphorus contents of the tops and of the stressed roots were significantly lower than those of the control. This would indicate an immediate reduction in phosphorus uptake under stress. Why stress on only one root should result in such a reduction throughout the plant is unknown but suggests an initial physiological shock.

Nitrate percentage in the tops was not affected significantly by applying a stress of 1 bar to one root. The nitrate percentage of the stressed root was significantly lower than that of the control, indicating that uptake was probably reduced and that internal translocation of nitrogen was not suf-