



Thesis Abstract

Alcohol Dehydrogenase Activity of *Cyperus rotundus* L. under Upland and Lowland Conditions

by Jennifer T. Peña, MS in Biochemistry, University of the Philippines Los Baños

Differences in morphology and biochemistry between upland and lowland *Cyperus rotundus* L. were investigated. The lowland ecotype was observed to develop longer and bigger root hairs, as well as greater tuber biomass. The bulk of carbohydrate reserve in the lowland tuber was in the form of soluble sugar, while that in the upland tuber was in the form of starch.

Alcohol dehydrogenase (ADH) activity was detected in the roots of both ecotypes upon germination in their respective habitats. Induction in enzyme activity was observed in both ecotypes after 24-hour hypoxia amounting to as much as 46.29-fold and 14.33-fold in upland and lowland ecotype, respectively. When hypoxia was prolonged to 48 hours, the upland nutsedge manifested a continuous rise in ADH activity, whereas, down-regulation was exhibited by the lowland counterpart.

Increases in soluble sugar were observed in the upland tuber during hypoxia, implying reduced utilization. Conversely, decreases in soluble sugar were evident in the lowland tuber upon germination and during hypoxia, the fold decrease being higher in the latter. Modulation in sugar utilization was manifested by the lowland tuber during prolonged hypoxia (48-hours) as a strategy to prevent early depletion of its carbohydrate store.

Starch metabolism was virtually passive in the upland tuber. On the other hand, increases in starch level were observed in the lowland tuber upon germination and during hypoxia, possibly because of reduced utilization during conditions of low oxygen availability.

It appeared that the tolerance of lowland *Cyperus rotundus* to hypoxia stems from its capacity to accumulate large amounts of soluble sugar, coupled with its remarkable ability to slow down its fermentation rate during prolonged hypoxia. It did so by down-regulation of its ADH activity and by exercising prudence in the release of its stored carbohydrate. Such concerted efforts ensured sustainability of substrate supply in the long run to avoid starvation that might otherwise lead to injury and eventual death of the plant.