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Nutrient Absorption by Duckweed[1]

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INTRODUCTION

Using *Spirodela polyrrhiza* (L.) Schleid., Muhonen, *et al.* (1983) demonstrated that the roots of these diminutive, floating, vascular hydrophytes contributed nothing of significance to the nutrition of these plants. This supported Hillman's (1961) contention that *S. polyrrhiza* will grow just as effectively without roots as with roots, contradicting Schulthorpe's (1967) reasoning that some absorption of nutrients should occur since vascular hydrophyutes do have an endodermis.

Muhonen, *et al.* (1983) concluded *S. polyrrhiza* grew just as well with roots excised or coated with paraffin as in the natural, rooted condition. It must therefore be assumed these plants absorb nutrients from water through some means other than roots. Because duckweed fronds float directly on the water surface, absorption of water and nutrients through the undersides of fronds is the most logical site for absorption to occur. The objective of this experiment was to test this assumption. For test purposes, it was assumed that neither removal of roots, nor coating of roots with paraffin, nor coating the undersides of fronds with paraffin would inhibit growth of the duckweed plants utilized in this study.

MATERIALS AND METHODS

Experimental conditions were similar to the experiments of Muhonen, *et al.* (1983). Differences were as follows: 1) The light source was two 60-watt GE "Gro-n-Sho" incandescent bulbs rather than two 40-watt Sylvania "Gro-Lux" fluorescent tubes; 2) the temperature was maintained at 27 C rather than 22.5 C; 3) *Lemna minor* (L.) was used instead of *Spirodela polyrrhiza.*

The aquaria for the first experiment were cleansed with Clorox bleach, then rinsed with sterile, deionized water three times. The tanks utilized for the second experiment were not contaminated with algae so were not washed with Clorox.

Gulfwax paraffin, with a melting range of 37-38 C, was used to coat roots and frond undersides. To coat a root, a frond was grasped gently with forceps to lower the root into melted paraffin as far as possible without dunking the frond. Fronds accidently dunked were rejected. To coat fronds, plants were inverted while the frond undersides were painted with melted paraffin using a small, soft paintbrush.

Nutrient absorption was assumed to be proportional to growth rates (Hillman, 1961). Growth rates were compared using an analysis of variance test to determine significance of differences existing among the treatments.

RESULTS AND DISCUSSION

The results of this experiment are presented in Table 1 as Experiments 1 and 2. Results of previous experiments (Muhonen, *et al.,* 1983) are summarized in Table 1 as Experiments 3-7.

The growth rate for Exp;eriment 1 plants was considerably less than for Experiment 2, presumably a result of the bleach treatment of the aquaria used for this Experiment. This supports observations made by Fitzgerald (1969), Barko (1980), and Muhonen, *et al.* (1983) concerning the effects of algal competition and algicides on the growth rates for duckweed.

If nutrient absorption is directly proportional to true growth rates, it may be concluded, based upon the data obtained from these experiments, that nutrient absorption is exclusively via the undersides of fronds of these

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TABLE 1. FROND GROWTH BY DUCKWEED WHEN ROOTED, WITH ROOTS EXCISED, WITH ROOTS COATED WITH PARAFFIN, AND WITH FROND UNDERSIDES COATED WITH PARAFFIN.

Exp. No.	Initial No. of Plants	No. of Culture Days	Reps.	Frond Growth with: Roots Intact	Roots Excised	Roots Coated	Fronds Coated
1	50	5	3	70	70 NS	70 NS	50 **
2	50	5	3	111	106 NS	110 NS	50 **
3	50	6	2	88	86 NS	88 NS	
4	50	11	2	71	60 NS	72 NS	
5	100	8	4	62	64 NS		
6	100	8	4	41	72 *		
7	100	3	3	16	16 NS		

Lemna minor was utilized for Experiments 1 & 2. *Spirodela polyrrhiza* was studied in Experiments 3-7 (Muhonen, *et al.*, 1983).
Frond Growth = average number of fronds produced during experiment.
ANOVA: NS = no significant difference; 5% level of probability.
* = significantly different; 5% level of probability.
** = significantly different; 1% level of probability.

duckweed plants. Roots apparently have little, if any, role in nutrient uptake by duckweed (Hillman, 1961; Sutcliffe, 1962; Titova, 1978; Muhonen, *et. al.*, 1983).

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