PHOTOSYNTHETIC PIGMENT COMPOSITION OF HIGHER PLANTS GROWN UNDER IRON STRESS

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1. INTRODUCTION

Iron deficiency causes a reduction in the thylakoid membrane system in higher plants (1). This reduction is accompanied by a decrease in all membrane components, including the light harvesting pigments chlorophylls and carotenoids. A decrease in the chlorophylls/carotenoids ratio has often been reported (2,3). The reason for this appears to be the relatively minor decrease in xanthophylls, by comparison to the decreases in chlorophylls and carotenes (2,4). The chlorophyll *a*/chlorophyll *b* ratio may also change under iron deficiency (5, see also 1), although no significant changes in the chlorophyll *a*/chlorophyll *b* ratio of green and chlorotic sugar beet leaves were found by Spiller and Terry (6).

The purpose of the present paper is to investigate the changes in the pigment composition of higher plants grown in the growth chamber under conditions of iron stress. Specifically, we want to address the question of the origin for the increases in the xanthophylls to chlorophyll ratio, i. e. whether all xanthophylls are less affected than chlorophyll by iron deficiency or, on the contrary, a specific xanthophyll(s) is responsible for the increase in the ratio carotenoids/chlorophylls. Also, we wanted to investigate whether or not iron deficiency modifies the chlorophyll *a*/chlorophyll *b* ratio.

2. PROCEDURE

Leaves were collected from sunflower (*Helianthus annuus* L. cv. SH-25) and peanut (*Arachis hypogaea* L. cv. Shulamit) plants grown hydroponically with different levels of iron. Ten to forty leaf discs, 0.358 cm² in diameter were taken with a cork borer and ground with 5 ml of acetone and a few milligrams of sodium ascorbate. The extracts were stored at -30°C until used. Pigment analysis was carried out by HPLC as described elsewhere (7). The mobile phase used was a gradient methanol/water (96/4 v/v):ethanol, followed by a ethanol isocratic step. The system separates routinely: neoxanthin, violaxanthin, taraxanthin, lutein, chlorophyll *b*, chlorophyll *a* and β -carotene. Antheraxanthin and α -carotene are also resolved, but in most materials their concentration is negligible.

FIG. 1. Relationship Between Neoxanthin (Closed Symbols) And Violaxanthin (open symbols) And Chlorophyll a In Sunflower (1A) And Peanut (1B) Leaves.

FIG. 2. Relationship Between Lutein (Closed Symbols) And β -carotene (open symbols) And Chlorophyll a In Sunflower (2A) And Peanut (2B) Leaves.