Short Communication

The Synthesis of Ribulose-1,5-Diphosphate Carboxylase and Chlorophyll in Virescent Cotton Leaves

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A number of reports suggest a close relationship between the development of ribulose-1,5-diphosphate (RuDP) carboxylase and chlorophyll in higher plants, algae and photosynthetic bacteria. Fuller and Gibbs (2) have shown that RuDP carboxylase activity is low in albino barley mutants compared with the levels in green barley. Streptomycin-bleached Euglena contains a lower amount of RuDP carboxylase activity than light grown Euglena. The synthesis of RuDP carboxylase and bacteriochlorophyll occur at the same rate in Rhodopseudomonas spheroides (6). Smillie (7) has shown the increase in the photosynthetic rate in greenening leaves parallels the development of RuDP carboxylase and photosynthetic pyridine nucleotide reductase. Hufnaker et al. (4) have also shown a high degree of correlation in the rate of synthesis of RuDP carboxylase and chlorophyll in green leaves. In this communication we show that the level of RuDP carboxylase in growing virecent cotton leaves is normal or higher than the level in control green leaves. The virecent leaves show a pronounced lag in chlorophyll development. There is no significant correlation between the rate of synthesis of RuDP carboxylase and chlorophyll in mutant leaves.

Virescent (5) and normal green cotton plants (Gossypium hirsutum L.) were grown in the field. Plants which had developed about 11 nodes were used for experiments. Leaves from the same node from several plants were collected. The leaves were rinsed with distilled H₂O and blotted. The main veins were removed and a portion of the leaves were used for chlorophyll analysis by the method previously described (1). The remainder of the leaves were ground in a chilled mortar in 0.1 M tris buffer pH 7.5 containing 1 mM GSH and sand. The brei was squeezed through 2 layers of cheesecloth and centrifuged 20 min at 27,000g in a refrigerated centrifuge. The supernatant fraction was removed and centrifuged in a 50 rotor at 50,000 rpm for 60 min in a Spinco model L centrifuge. An aliquot of this soluble supernatant was used for assay of RuDP carboxylase.

The development of chlorophyll and RuDP carboxylase in growing leaves of virecent and green cotton plants is shown in Fig. 1. In the leaves sampled from the ninth to the second node (the first node is at the primary leaf) the development of chlorophyll is far slower in the virecent leaves. If

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1 This work was supported in part by the Cotton Producers Institute.
2 Mention of brand names does not imply USDA approval to the exclusion of products of other firms.
RuDP carboxylase was synthesized at the same rate as chlorophyll, the development of the carboxylase on a leaf weight basis should parallel chlorophyll development. This is not the case. The development of RuDP carboxylase in virescent leaves parallels the development of this enzyme in normal green leaves. The rate of synthesis may be slightly faster in the yellow leaves. On a chlorophyll basis the development of RuDP carboxylase in virescent leaves far exceeds the development of this enzyme in green leaves (Fig. 2). These data demonstrate conclusively that RuDP carboxylase synthesis far exceeds the synthesis of chlorophyll in virescent cotton leaves.

In virescent cotton mutants the products of nuclear genes might act on a hypothetical regulator gene on the chloroplast chromosome (3). This action could cause a lag in chlorophyll synthesis possibly by affecting the structural units required for chlorophyll and carotenoid synthesis (1). The results in this paper show that if this type of control of pigment development applies, it does not interfere with the synthesis or development of RuDP carboxylase.

**Literature Cited**