# ASCORBIC ACID AND *FUSARIUM* WILTED PLANTS

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## Introduction

The degree of cellular activity and rate of metabolism of plant tissues has been correlated with concentration of ascorbic acid, those tissues with greatest cellular activity and highest metabolic rate having relatively high ascorbic acid content (Bessey and King, 1933; King, 1936). It is well recognised that chlorophyll-bearing tissues tend to have the highest concentrations of ascorbic acid (Veselkine, *et al.*, 1937), although there is not necessarily a close parallelism between the quantity of chlorophyll and ascorbic acid in any tissue (Randoin, *et al.*, 1936). That ascorbic acid plays an important part in the plant respiratory system is also well known (Szent Gyorgi, 1930).

There appears to be no report so far on the ascorbic acid content of plants infected by fungi in their aerial parts or by soil-borne root infecting fungi causing vascular wilts, although recent work on phytotoxicity of certain antibiotic substances has indicated general dechlorophyllation in wheat by Streptomycin (Wright, 1951). As the first detectable external symptom of wilt diseases is dechlorophyllation (possibly a manifestation of toxemic condition), it seemed to be of interest to follow up the ascorbic acid build up of wilt infected plants under laboratory and field conditions. The organisms and hosts chosen were *Fusarium vasinfectum* on cotton (*Gossypium arboreum* variety K 2) and *Fusarium udum* on red gram (*Cajanus cajan*). Reducing sugar content of wilting leaves was also estimated along with ascorbic acid content since claims and counter claims have been made on its rôle as the immediate precursor of ascorbic acid (Ray, 1934; Guha and Ghosh, 1935; Hawthorne and Harrison, 1937).

## Materials and Methods

Cotton plants were grown in sand-culture and were inoculated with the pathogen in the form of mycelial mats. The uninoculated series served as the control. Red gram plants were grown in the laboratory garden soil which is known to produce wilt of red gram every year. Weekly estimations of ascorbic acid were conducted on the leaves of cotton and red gram following Indo-phenol Xylene extraction method (Robinson and Stotz, 1945).

Reducing sugar content of the leaves was also estimated following a standard method (Hagedorn and Jensen, 1923).

## Results

Results given in the accompanying Tables I and II indicate that these vascular wilts brought about a striking reduction in the ascorbic acid content of the leaves of both hosts and also an increase in the reducing sugar content.

TABLE I. *Cotton*

| Age of plant (in days) | Ascorbic acid (mg./100 g ) Fresh weight (mean values) | | Reducing sugar (mg. %) Dry weight (mean values) | |
|---|---|---|---|---|
| | Inoculated | Uninoculated | Inoculated | Uninoculated |
| 10 | 46·82 | 31·30 | 3·48 | 3·23 |
| 17 | 73·87 | 64·20 | 3·76 | 3·85 |
| *24 | 96·70 | 91·80 | 5·39 | 3·79 |
| *31 | 88·80 | 97·85 | 5·59 | 4·14 |
| 38 | 72·60 | 103·85 | 5·37 | 4·47 |

* Severe wilt symptoms were seen during this period.

TABLE II. *Red Gram*

| Age of plant (in days) | Ascorbic acid (mg./100 g.) Fresh weight (mean values) | | Reducing sugar (mg. %) Dry weight (mean values) | |
|---|---|---|---|---|
| | Diseased | Healthy | Diseased | Healthy |
| *50 | 183·0 | 221·0 | 7·62 | 4·75 |
| *57 | 173·2 | 216·8 | 9·30 | 5·15 |
| 64 | 151·6 | 228·8 | 7·30 | 5·46 |
| 71 | 150·8 | 180·5 | 6·45 | 5·14 |
| 78 | 144·6 | 210·2 | 5·40 | 4·85 |
| 85 | 130·4 | 161·0 | 7·60 | 6·19 |

* Wilt symptoms were seen between the sixth and eighth weeks after planting seedlings.

## Discussion

Since ascorbic acid seems to play an important rôle in the overall growth process of plants and animals (King, 1938) and as it is closely associated

with the chlorophyllous tissues, it is reasonable to conclude from the above results that dechlorophyllation and retarded growth, which seem to precede the actual wilting of plants, cause a decrease in the ascorbic acid content. The higher ascorbic acid content of the cotton plants of inoculated series before wilting may be due to an increased metabolic activity of the plant in an attempt to resist the disease in the early stages. The higher reducing sugar content of the inoculated and the diseased plants over the normal ones is of particular interest if we assume that the reducing sugars are the precursors of ascorbic acid. There is presumably a breakdown in the normal metabolism of wilt-affected plants, especially the photosynthetic activity and there is reason to assume that this breakdown in the normal metabolism starts far in advance of the actual wilting of plants. Further work on these lines are being continued to find out the exact nature of host metabolism connected with these vascular wilts.

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