

the chlorophyll *a/b* ratio in all the treatments did not show any marked difference (table 2). As compared to the control, the red radiation enhanced the level of the total chlorophyll marginally (13%) whereas the blue radiation led to a sharp decrease in synthesis of chloroplast pigments (table 2). Earlier workers have observed that red light greatly enhanced the formation of chloroplast pigments than blue light in barley seedlings<sup>5</sup>, *Pinus sylvestris*<sup>6</sup> and in green embryos of *Dolichos*<sup>1</sup>. However, in certain algae and higher plants, the synthesis of chloroplast pigments was higher in blue radiation than in the red<sup>7-9</sup>. The red radiation enhancement of the chlorophyll formation<sup>10</sup> over the blue radiation is rather intriguing as blue radiation regulates  $\delta$ -aminolevulinic acid formation as well as certain steps involved in the production of reductant required for photoreduction of protochlorophyll to chlorophyll<sup>11,12</sup>.

As compared to red radiation, red (outer) + blue (inner) or vice versa combinations reduced the synthesis of pigments (table 2). Although the intensities of light transmitted by these combinations were similar (but less when compared to blue plastic sheet as in table 1), the formation of chlorophyll was marginally higher under red (outer) + blue (inner) combination than in blue radiation or blue (outer) + red (inner) combination. While this is suggestive of phytochrome control, the exact mechanism for the enhancement of chlorophyll in this combination [red (outer) + blue (inner)] is not clearly understood.

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#### HISTOPATHOLOGICAL STUDIES IN THE NEMATODE GALLS OF ROOT OF *SOLANUM SURATTENSE*

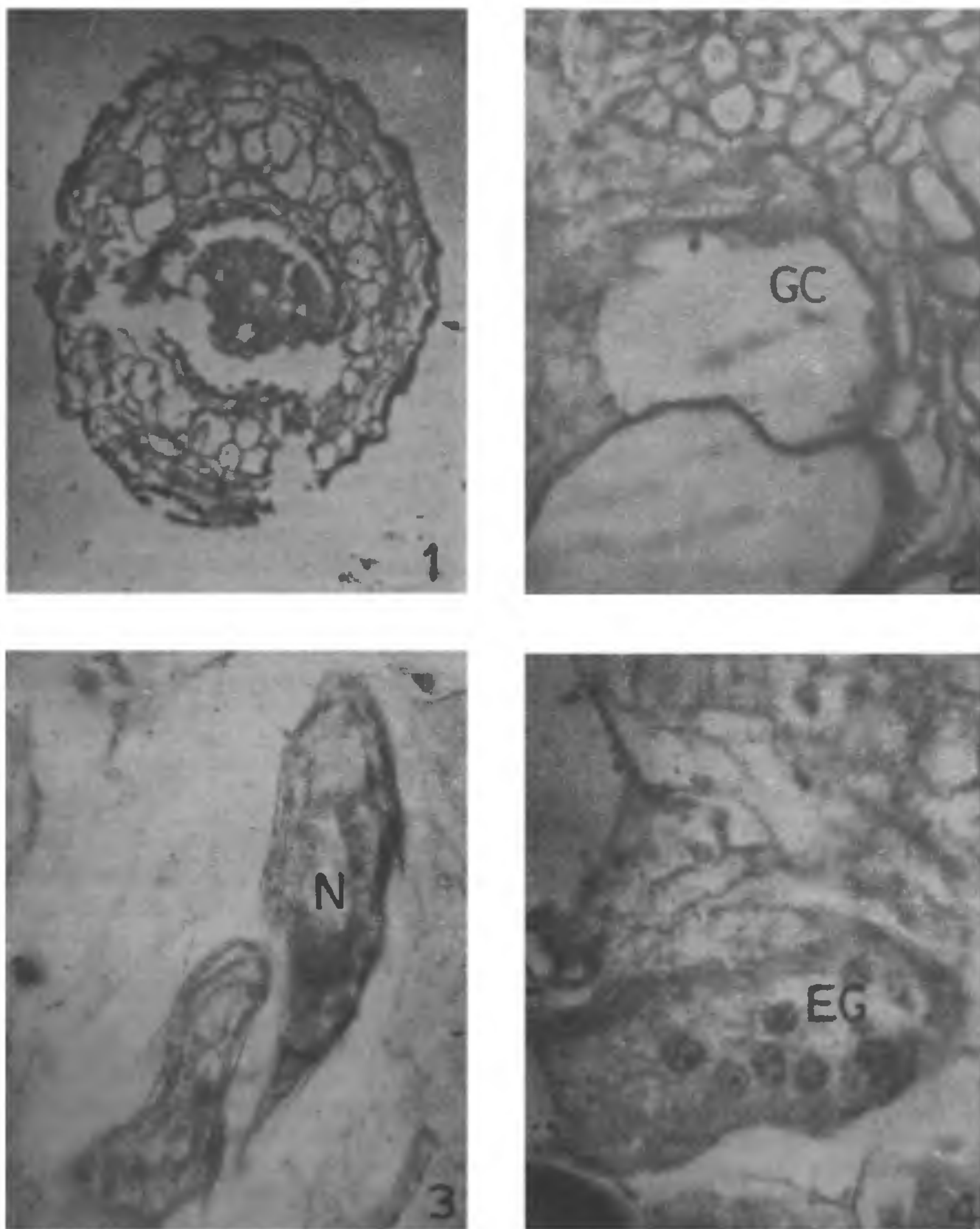
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*SOLANUM SURATTENSE* Burm F. is a member of the family Solanaceae. This prickly herb is found along the road side, bunds of canals, raised borders of crop fields and such other places where soil is freshly dug and piled. This plant is used in different human and cattle ailments.

Root nematodes of angiosperm have been studied by several workers<sup>1-4</sup>. However, a study of this type has not been undertaken on *S. surattense*. An effort has therefore been made during the present investigation to study the nematode galls of roots of this plant.

For the present study, the normal and infected roots of *S. surattense* were collected from the fields of Rewa, fixed in FAA at 25°C for 24 h and preserved in 70% alcohol. The pieces of normal and infected roots were dehydrated and cleaned in alcohol xylol and tertiary butyl alcohol and embedded in paraffin wax. The roots were then sectioned at 5–11  $\mu$  by microtome. Haupt's adhesive was used for affixing the section on the slide. To understand the mode of nematode infection and host parasite relationship, the microtome sections of normal and infected roots, were stained with Heidenhain's and Delafield's haematoxylin and safranin fast green combination<sup>5</sup>.



Figures 1-4. TS roots of *Solanum surattense* (Normal as well as infected). 1. Normal root showing different parts ( $\times 65$ ); 2. Infected root showing disruption of host tissues and presence of giant cells (GC) ( $\times 520$ ); 3. Infected part showing poor stained cortical tissues and highly stained nematode (N) ( $\times 520$ ); 4. The eggs (EG) of the nematode showing intense reaction ( $\times 520$ ).

The normal root of *S. surattense* shows tap root system, and in TS they appear tetrach (figure 1). Secondary phloem develops centrifugally while secondary xylem develops centripetally from the vascular cambium.

The infected root in TS, reveals that the nematode penetrates the cuticle and epidermis and ultimately reaches the cortical as well as vascular region. The result of the nematode entry is a massive increase in the number and the size of the host cells. The interesting feature is the presence of a large number of giant cells (figure 2), which are formed due to dissolution of cell walls of adjacent cells and consequently a bigger cell is formed with many nuclei.

With the increase in the intensity of infection, the vascular region is also affected and xylem and phloem are damaged. The severity of nematode infection also leads to a significant change in the thickness of the roots and the heavily infected roots are 10–15 times thicker than those of normal ones. The damage to the vascular tissues may be causing blockage of conduction of food and water. In certain tissues the mature female nematode is seen (figure 3). The nematode also lays eggs in the host plant (figure 4).

The hypertrophy and hyperplasia of cells of pericycle and vascular elements may cause gall formation<sup>1,4</sup>. Orion and Roberts<sup>6</sup> emphasized that the element of the gall is cortical hypertrophy which occupies most of the *Meloidogyne* sp. gall on tomato and was associated with the process of nematode maturation. In the present study the nematode development initiates growth mechanism resulting in hypertrophy of the cortical parenchyma of the root.

Dropkin and Nelson<sup>2</sup>, and Krusburg<sup>7</sup> observed the dissolution of the cell walls of giant cells resulting in larger giant cells by coalescing with the bordering giant cells. Rao and Kumar<sup>4</sup> stressed that they have been observed to form only in the vascular tissues, while the present study reveals that the giant cells extend abnormally towards the vascular tissues resulting in the discontinuity of vascular tissues.

Bird<sup>8</sup> reported that the multinucleate condition in giant cells is due to acquisition of nuclei from the incorporated cells. However, Huang and Maggenti<sup>9</sup> stated that the giant cells become multinucleate on account of karyokinesis. In addition to the multinucleate giant cells the authors have observed nuclear hypertrophy as reported by Bird<sup>8</sup> and Huang and Maggenti<sup>9</sup>. They, however, find that cytoplasm also becomes vacuolate in the giant cells. Bird<sup>8</sup> has

given the reason for its formation mainly due to nuclear enlargement, followed by cell wall breakdown, synchronous mitosis and incorporation of adjacent cells. Similar reports have been confirmed by Maheshwari<sup>3</sup>.

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#### CHANGE IN ASCORBIC ACID CONTENT IN TOMATO FRUIT INOCULATED WITH *ASPERGILLUS NIGER* AND *DROSOPHILA BUSCKII*

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ASCORBIC acid is an important component of fruits. Changes in ascorbic acid content in tomato fruit as a result of fungal infection have earlier been reported<sup>1,2</sup>. There is, however, no information on the change in ascorbic acid content when fruits are infected with a fungus in the presence of an insect. In the present note change in the ascorbic acid content of tomato infected with *Aspergillus niger*, a fruit-rot fungus in the presence of an insect, *Drosophila busckii* is reported.

Healthy tomato fruits of the same size and age were surface-sterilized with ethyl alcohol, inoculated with spores of *A. niger* and fed by *D. busckii* for different durations (10–30 min). The ascorbic acid content of the tomato fruit tissue was deter-