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INFLUENCE OF *MELOIDOGYNE INCOGNITA* ON LIPID AND PROTEIN CONTENT OF *CAPSICUM ANNUUM*[1]

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ABSTRACT

Changes in lipid and protein content in chilli root galls due to infestation by *Meloidogyne incognita* was recorded. Galls showed increase in lipid and protein contents. The eggs, nema bodies, developing giant cells and the parenchyma surrounding them stained strongly for lipids and protein but degenerated giant cells showed less of these contents.

INTRODUCTION

Chilli (*Capsicum annuum* L.) is an important vegetable crop. It is attacked by root-knot nematode, *Meloidogyne incognita* Chitwood which has attained a major pest status in Jaipur. It inflicts heavy injury to the roots leading to poor yield of fruits. Studies on histochemical localisation of various metabolites in healthy and *Meloidogyne* sp. infected galls are meagre (Bird, 1961; Scheetz and Crittenden, 1966). Information on changes in the lipid and protein content due to *Meloidogyne* infestation in chilli is the first of its kind in this plant and the details are presented here.

MATERIAL AND METHODS

One week old chilli seedlings were transplanted to 15 cm pots containing one kg sterilized soil. Each plant was inoculated with 1000 freshly hatched larvae of *Meloidogyne incognita*. Uninoculated plants served as control. Infected roots of chilli were collected from experimental pots at various interval till 45 days after inoculation. Healthy roots of same age were collected for comparison with galled roots. The FAA fixed material was dehydrated and cleared through tertiary butyl alcohol series, infllterated and embedded in paraffin wax. Tranverse as well as longitudinal sections were cut at 12 micron. Localization of lipids was done by Sudan III/IV (Gomori, 1952 Jensen, 1962) and Sudan Black-B-method (Modified from Jensen, 1962). Both freehand fresh sections and microtome sections were stained to locate the lipids in the tissue. Localisation of total proteins was done by Mercury-Bromophenol Blue (M.B.B.) method (Modified from Mazia *et al.*, 1953 ; Ruthman, 1970).

OBSERVATIONS

Localisation of total protein :

Healthy root : The root showed dark blue stain of MBB showing high amount of protein both in cytoplasm and

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nuclei, the nucleolus stained more densely. The pericyclic and phloem cells showed higher protein content.

Galls : The galls were richer in protein than the healthy root. More protein was noted in tissue near the infection site. The walls of tracheary elements took blue stain non-specifically. The giant cells showed a gradual increase of protein in their cytoplasm and nuclei, becoming maximum as the nematode reaches maturity. However, the walls stained negative for protein. The parenchymatous cells lining the cavity containing female and egg mass stained positive for protein. All the developmental stages of nematode larvae showed rich protein reaching the maximum in ovipositing female. A dead nematode, however, stained bluishblack (Figs. 1-4). In the control slides protein containing regions remain unstained.

Localization of lipid :

Healthy root : Lipids were localised as red globules by staining the tissue with Sudan III/IV. Healthy roots showed them in root parenchyma and they increased in amount as the root matured. With Sudan Black B sudanophilic substances stained deep blue in colour. Phloem and endodermal cells stained deeply.

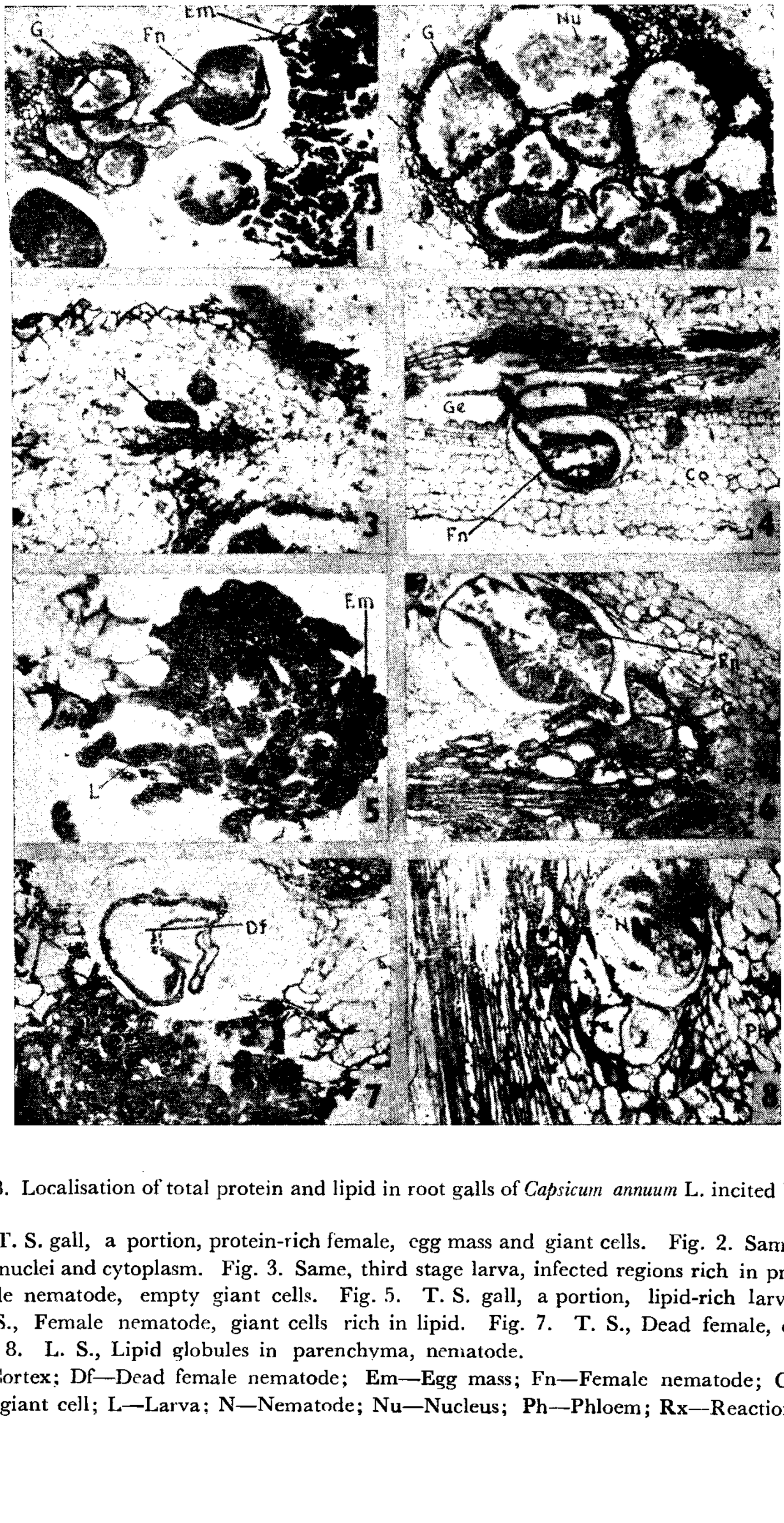
Galls : The galls showed an increase in total lipids over the healthy root. Lipid globules were concentrated more in the eggs, nema bodies, giant cells and the parenchyma surrounding them. The remaining parenchyma cells contained smaller globules. The young galls showed many small globules in parenchyma cells and they were more abundant in giant cells. It was noted that cells lining the nematode cavity showed more lipid globules of various sizes (Figs. 4-8).

With Sudan Black B-,—galls stained more than the healthy roots indicating an increase in sudanophilic substances. The infected areas stained deeply. The peripheral portions of the gall and the nuclei of all the cells stained deep blue. Parenchyma of medium and large galls showed bluish black granules. The nematode of all ages, egg contents, specially the inner lining of colourless egg shell took a deep blue stain. Plenty of sudanophilic granules were seen in the nematode body and the egg. As the nematode developed, and the giant cells matured, more and more blue black granules were seen in the cytoplasm. Giant cell wall stained negative for lipids. Degenerating giant cells showed the absence of lipid.

DISCUSSION

Lipid in chilli root galls increased, a higher amount of lipid was noted in mature giant cells and the nematode. Paulson and Webster (1970) reported lipid droplets in three week old giant cells. On dry weight basis, galls showed 154% increase in lipids (owens and Specht, 1966). In chilli galls, the parenchyma cells lining the cavity containing the female or eggmasses contained sudanophilic globules. The peripheral lining of lysigenomata in galls (Scheetz and Crittenden, 1966) and the cells producing the gelatinous matrix were rich in lipids (Bird and Rogers, 1965).

In the present study, there was an increase in protein content in the galls as compared to the corresponding healthy roots and it was principally localised in giant cells and nema bodies. There was no increase in protein in cucumber, but a slight increase in tomato galls was observed by Zinovev (1964), who found an increaes in non-protein nitrogen in the former. Paulson and Webster (1970) reported the presence of proteinaceous crystalline bodies in 10 days old giant cells which dissolved away during breakdown of the giant cells. In the present study,



Figs. 1-8. Localisation of total protein and lipid in root galls of *Capsicum annuum* L. incited by *Meloidogyne incognita*.

Fig. 1. T. S. gall, a portion, protein-rich female, egg mass and giant cells. Fig. 2. Same, giant cells, protein-rich nuclei and cytoplasm. Fig. 3. Same, third stage larva, infected regions rich in protein. Fig. 4. L. S., Female nematode, empty giant cells. Fig. 5. T. S. gall, a portion, lipid-rich larvae and eggs. Fig. 6. L. S., Female nematode, giant cells rich in lipid. Fig. 7. T. S., Dead female, egg mass with lipids. Fig. 8. L. S., Lipid globules in parenchyma, nematode.

(CO—Cortex; Df—Dead female nematode; Em—Egg mass; Fn—Female nematode; G—Giant cell; Ge—Empty giant cell; L—Larva; N—Nematode; Nu—Nucleus; Ph—Phloem; Rx—Reaction xylem; X—xylem).

there was a gradual increase in granular protein in giant cells until they reached maturity. A degenerating syncytium, however, stained feebly indicating a reduction in its protein content.

Owens and Bottino (1966) reported the absence of protein giant cell wall and the same was found to be true for chilli galls. In chilli the nematodes of all stages stained strongly for protein. The cuticle of the nematode and matrix of the eggmass stained positive for protein suporting Bird (1974) who reported cuticle to be lipoproteinaceous in nature. In the female of *M. javanica*, both the cells producing the gelatinous matrix and the matrix itself stained positive for protein histochemically (Bird and Rogers, 1965).

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