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# HISTOCHEMICAL PROFILE OF STEM GALL OF *INDIGOFERA ATROPURPUREA* BUCH. HAM.INDUCED BY AN UNKNOWN MIDGE

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Stem galls of *Indigofera atropurea* Buch.Ham. are induced by an unknown midge. A marked difference in the anatomy was observed between gall and normal tissues. Distribution of various metabolites and activities of enzymes like polyphenol oxidases, peroxidases and acid phosphatase in the infected tissue suggests a definite alteration in the metabolic activity of the host to the advantage of the insect.

**Keywords** : Enzyme activity, Histochemistry; *Indigofera atropurpurea* ; Metabolites.

## Introduction

Stem galls of *Indigofera atropurea* Buch.Ham. are caused by an unknown midge of the order Diptera. Heavily infested plants were found in Nainital and Garhwal regions of Uttar Pradesh during the months of July to October. Galls on this plant are indehiscent swellings of axillary or terminal buds. The bulk of gall is made up of parenchyma cells. The larval cavity is lined by polygonal cells of nutritive zone. These cells have dense cytoplasm and prominent nuclei. Histochemical profile of the gall was studied to understand the cellular and subcellular changes which lead to the development of abnormal growth.

## Material and Method

Normal stem and stem galls of *Indigofera atropurpurea* were collected from Nainital and adjoining areas. The following metabolites were localised histochemically. Proteins [Amido Black stain][1], Lipids [Sudan III dye][2], Starch [IKI reaction][3], Tanin [Lugol's iodine][4]. Apart from these, activities of enzymes like Polyphenol oxidase[5], Peroxidase[6] and Acid Phosphatase[7] were also localised. Their qualitative increase /decrease was assesed in terms of intensity of staining and the degree of distribution of the stain in the tissues.

## Observations

Histochemical localisation of various metabolites and activity of enzymes in normal and gall tissues is shown in table 1. In normal stem tissues high concentration of protein was restricted to cortex, phloem and medullary ray regions. On the whole gall tissues showed a higher concentration of proteins as compared to normal tissues. Proteins were observed throughout the gall parenchyma. Abundance of starch granules was observed in gall parenchyma. The intensity of starch deposition was more in

cell layers away from the nutritive zone. Gall tissues showed presence of lipids in the outer cortex regions and in cells of nutritive zone whereas a feeble reaction for lipids was observed in the tissues except in cork region. Tanin filled cells were observed away from the nutritive zone in gall tissues. Activity of enzymes polyphenol oxidase, peroxidase and acid phosphastase were significantly higher in nutritive zone as compared to the gall cortex.

**Discussion**

Stem galls of *Indigofera atropurpurea* develop as a result of the cecidogenic acitivity of the feeding larva of the midge. Accumulation of proteins in the gall tissues, maximum being in the nutritive zone, helps the cecidozoan in its growth and development. This increased concentration of protein can be correlated with increased peroxidase acitivity[8]. Increased protein synthesis in response to wounding has been reported[9]. Westphal[10] and Kant *et al.*[11] also reported increased incidence of protein in gall tissues of some mite induced galls. Occurence of starch in the gall parenchyma suggests the utilisation of starch in the form of soluble saccharides diffusing through cortical cells. Similar results have been reported by several workers[11-13]. Lipids in the nutritive zone sustains the feeding larva over a long period. A significant increase in lipids in gall tissues as compared to normal, especially in nutritive region has also been observed in several insect induced galls[11, 14-16]. Absence of tannins in the nutritive zone stem gall of *Indigofera atropurpurea* could be due to higher peroxidase activity in this region. High activity of peroxidase suggests that the oxidation of phenolics was carried out peroxidatively[17].

Predominant activity of acid phosphatase in gall tissues, maximum being in nutritive zone suggests a higher metabolic activity in cells of nutritive zone[11,18]. Feeding activity leads to increased synthesis of enzymes like polyphenol oxidase, peroxidase and acid phosphatase. Increased activity of these enzymes in gall tissues especially the nutritive zone leads to higher auxin activity, increase in growth and metabolism and accelerated protein synthesis. Thus there is mobilisation and accumulation of metabolites in the gall tissues which are then utilised by the gall maker.

**Table 1.** Histochemical localization of metabolites in normal and gall tissues of *Indigofera atropurpurea* stem.

| S.No. | Metabolites | Normal/gall | Regions localized | Intensity |
|---|---|---|---|---|
| 1. | Protein | Normal | Cortex | ++ |
| | | | Phloem | +++ |
| | | | Medullary ray & pith | +++ |
| | | Gall | Cortex | +++ |
| | | | Nutritive zone | ++++ |
| 2. | Starch | Normal | Cortex | + |
| | | | Medullary ray | + |
| | | | pith | ++ |
| | | Gall | Cortex | ++++ |
| | | | Nutritive zone | ++ |
| 3. | Lipids | Normal | Cork | +++ |
| | | | Xylem | + |
| | | Gall | Cortex | + |
| | | | Nutritive zone | +++ |
| 4. | Tanin | Normal | Cork | - |
| | | | Xylem | ++ |
| | | Gall | Cortex | ++++ |
| | | | Nutritive region | - |
| 5. | Acid Phosphatase | Normal | Cortex | ++ |
| | | | Phloem | ++ |
| | | | Medullary ray | ++ |
| | | | pith | + |
| | | Gall | Cortex | +++ |
| | | | Nutritive zone | ++++ |
| 6. | Peroxidase | Normal | Cortex | +++ |
| | | | Phloem | +++ |
| | | | Medullary ray | ++ |
| | | | pith | + |
| | | Gall | Cortex | + |
| | | | Nutritive zone | +++ |
| 7 | Polyphenol oxidase | Normal | Cortex | ++ |
| | | | Phloem | +++ |
| | | | Medullary ray | ++ |
| | | | Pith | ++ |
| | | | Cork | + |
| | | Gall | Cortex | + |
| | | | Nutritive zone | +++ |

Very low intensity+, Low intensity ++, High intensity +++, Very high intensity ++++.

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