

## HISTOCHEMICAL STUDY OF CELLULOSE IN FLOWER GALLS OF *CALLIGONUMPOLYGONOIDES*L.

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### ABSTRACT

*Galls, the plant tumours have been known since mythical and biblical times. Yet, it was not until the turn of the last century and the early twentieth century, that their classification ecology and relationship with the animal kingdom have been established. Even today the physiology and biochemistry of tumor induction seems to puzzle scientists. Galls are neoplastic growths resulting from the reactions of plant species to various kinds of stimuli. Diverse species of insects which infect plant tissues to spend a part of their life cycle cause gall formation. Gall morphogenesis is the result of interaction between morphogenetic control of the plant body and the insect factor (Miles, 1968). Thus, the galls are unique examples of complex interactions and mutual adaptation between the host and pathogen caused by cellular hypertrophy and hyperplasy.*

**Keywords:** Galls, Neoplastic, hypertrophy, hyperplasy.

### Introduction

In our country Ramakrishna (1920,1928) generated interest in galls and gall workers. Later, Sunder Raman (1924) and Saksena (1942) provided information on comparative morphology of few insect galls. With the publication of 'Cecidozoa' and 'Zoocecidia' (Mani, 1948) cecidology developed into a separate biological discipline.

Kuster (1911) classified plant galls in two categories (i) Histoids and (ii) Organoids. According to Mani (1964) galls may be (i) limited, where characters of the galled tissue do not depart widely from the normal plant. This category includes galls induced by nematodes, insects, mites and fungi (ii) unlimited, where the degree of abnormal growth is not controlled by the nature of the plant but by the inducing factor.

Plant galls or tumour diseases of economically important plants are very harmful and cause tremendous loss of revenue.

*Calligonumpolygonoides* L. is an important plant of arid and semi-arid regions. In Western Rajasthan "Phog" is the common name for *Calligonumpolygonoides* L., which belongs to family polygonaceae. It is a rigid, much branched almost leafless shrub. Its wood is used in building huts wells etc. The branches are eaten by camels. The buds called 'lasson' are used by the villagers as food. The decoction of the plant after boiling is used as a gargle for the sore-gums. The coal prepared from this plant is used by iron-smith etc. Gautam and Bishnoi (1991) have studied the influence of root and shoot extracts of some desert plants on seed germination of *Calligonumpolygonoides* L. The flowers are pinkish, fasciculate in the axils of ocreae. This plant of great economic importance suffers from flower galls induced by an unknown mite. In severe infection complete inflorescence converts into gall. These flower galls have been chosen for the present investigation. This plant is propagated by seeds.

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To understand the physiological changes in terms of morphology, histochemical studies were carried out. These studies are useful in providing information regarding the distribution and accumulation of various metabolites and enzymes in the tissue organ.

Normal plant represents a system of inter-related biochemical reactions in a state of dynamic equilibrium. Many biochemical changes take place at the infection site in plants during establishment of host-parasite relationships. Some of the biochemical changes tend to disturb the equilibrium favouring the abnormal growth. It is therefore necessary to understand these biochemical changes in situ. Qualitative histochemical studies on localization of various chemicals provide an insight into the biochemical phenomenon at the cellular level and is of immense value in studies involving physiology of parasitism and also in evaluating the histopathological aspects of host parasite relationship.

## **Material and Method**

### **Cellulose**

IKI – H<sub>2</sub>SO<sub>4</sub> method of Johansen (1940) was followed for localization of cellulose.

### **Procedure**

Fresh hand cut sections were kept in IKI solution for 15 minutes and mounted on a glass slide. Through the sides of the cover glass a drop of 65% sulphuric acid was allowed to diffuse in and the sections were immediately photo-micrographed.

### **Results and Observations**

Cellulose stained dark blue to black. Cellulose was observed in inner mesophyll cells in *Calligonum* normal flower. Few outer parenchymatous cells also exhibited a positive reaction for cellulose (Fig. 9C). In *Calligonum* gall cells around gall cavity also showed presence of cellulose, besides outer parenchyma (Fig. 9D).

Cellulose is the most abundant organic compound that occurs in plants. It is the main constituent of cell walls and is responsible for their structural rigidity. The IKI H<sub>2</sub>SO<sub>4</sub> test is based essentially on the same H<sub>2</sub>SO<sub>4</sub> principle as IKI procedure for starch. Iodine accumulates within the cellulose molecule, but only if the structure of the molecule is broken. For this reason acid is introduced to disrupt the hydrogen bonds which maintain the molecular structure. This results in separation of glucose strands. Iodine accumulates in the enlarged space and the characteristic blue colour appears. When lignin is present along with cellulose, lignin not only gives a different color reaction but color reaction of cellulose is also interfered. (Whaley et al. 1952).

In *Calligonum* normal flower, cellulose was observed in inner mesophyll, while in gall, cells around gall cavity showed presence of cellulose. But mostly it was observed that the yellow-orange colour signifying the presence of lignin was more dominant than the blue colour of cellulose both in normal and gall tissues. The possible explanation for this could be that the hydrogen bonds which maintain the molecular structure of cellulose were not disrupted properly or presence of hemicelluloses interfered with the development of blue colour. In cork in normal rachis.

The 'Insect' galls are unique example of complex interactions and mutual adaptation between the host and the pathogen characterized by cellular hypertrophy and hyperplasia. Plant galls are of much economic significance and several galls are used in medicines.

Plant galls or tumour diseases of economically important plants are very harmful and cause tremendous loss of revenue. *Calligonum polygonoides* Linn., *Prosopis cineraria* Linn. Druce & *Salvadora persica* Linn. are important plants for the economy of the people residing in the arid and semi arid zones of India.

In the normal flower of *Calligonum polygonoides* Linn. inner mesophyll layers exhibited presence of cellulose whereas in gall, it was found around gall cavity. In the normal rachis of *Prosopis cineraria* (Linn.) Druce outer layers of cork exhibited presence of cellulose whereas in gall cork layer had lesser cellulose, however a few cortical cells showed presence of cellulose.

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