



Study of Some Metabolites and Enzymes in Insect Induced Leaf Galls of *Pongamiapinnata* (L.)

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ABSTRACT

There are various gall causing agencies in nature. Present study was thus undertaken on biochemical changes in leaf galls of *Pongamia* due to infection of *Aceriapongamiae*. The parameters assayed were total protein, total auxin content, free auxin content, IAA oxidase and invertase activity compared to normal tissues. Quantitative estimation of these metabolites and enzymes showed distinct variations in leaf gall at different ages with their normal counterparts.

Key words : *Pongamiapinnata*, total protein, total auxin content, free auxin content, IAA oxidase, invertase activity, Enzymes.

INTRODUCTION

Pongamiapinnata (Karanja) would be very suitable for marginal fallow and waste land of arid and semi-arid of India. It is an amazing tree that was brought to the forefront by a need for a renewable biofuel resource. The tree has considerable economic importance in India and is also known to have tremendous diversity. *Pongamiapinnata* is also economically important for the seed oil content and quality, due to which the oil has been recognized as an important bio-fuel (Rana and Ranade 2009).

According to the Kuster (1930) the gall is the product of biological reaction between host and parasite. The insect activates a perturbation in growth mechanisms and alters the differentiation processes in the host plant, modifying the plant's architecture to its advantage (Raman 2003). *Pongamia* suffers galls on its leaf attacking by some pathogens which decrease its seed production to reduce its economic value. Mani (1964) has described the interaction between the morphogenetic control of plant body and the insect factor. According to Rosenthal and Jenzen (1979) an interaction between the offensive stimuli involving growth substances released by insects and defensive response by plant appears to be the hallmark of gall production. Amounts of protein are higher in gall tissues than normal tissues (Choudhary and Kumar, 2009).

EXPERIMENTAL SECTION

Normal and galled *Pongamiapinnata* leaves of equal size were collected from KeolaDeo National park, Bharatpur, Rajasthan and their biochemical study was done. The biochemical parameters were studied in normal and gall leaf at different ages (10 days, 20 days and old).

The amount of total protein by Lowry *et al* (1951), the amount of total auxin contents, free auxin content and IAA oxidase were estimated by the method of Avery *et al* (1945). A modified method of Harris and Jaffcoat (1974) was used for estimation of invertase activity.

RESULTS

The results are presented in Fig. - 1 to 15 (◆- represent normal leaf, ■-represent leaf gall).

Total protein:

High protein was found in the gall tissue (10days and 20days) as compared to normal tissue. Low protein was found in gall tissue (old) as compared to normal tissue. 10days gall showed highest amount of protein as compared to 20days and old galls.

Total auxin contents:

Lower amount of total auxin contents was found in the gall tissue (10days, 20days and old) as compared to normal tissue. Old gall showed highest amount of total auxin contents as compared to 10 days and 20days galls.

Free auxin contents:

Higher amount of free auxin contents was found in the gall tissue (10days, and old) as compared to normal tissue. Lower amount of free auxin content was found in 20 days gall tissue as compared to normal tissue. 10 days gall showed highest amount of free total auxin contents as compared to 20days and old galls.

IAA oxidase activity:

IAA oxidase activity was recorded to be more in gall tissue (old) as compared to normal tissue. Lower amount was recorded in 10days and 20 days gall tissues as compared to normal tissue. Highest amount of IAA oxidase activity was observed in 10days gall as compared to 20days and old gall.

Invertase activity:

Invertase activity was recorded to be more in gall tissue (10 days, 20 days and old) as compared to normal tissues. Maximum invertase activity was observed in old gall as compared to other 10 days and old galls.

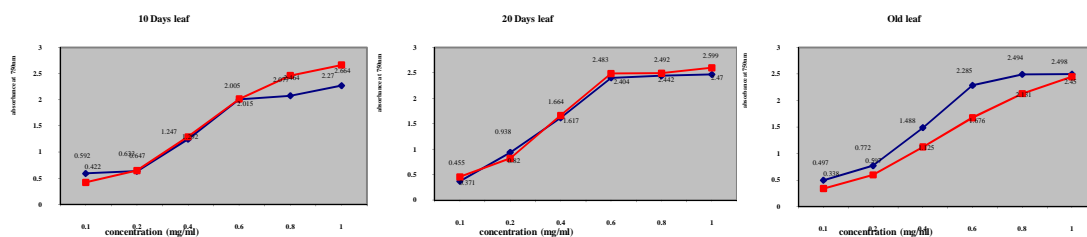


Fig: 1, 2 and 3 showing amount of protein in normal and gall (10days, 20days and old) leaf.

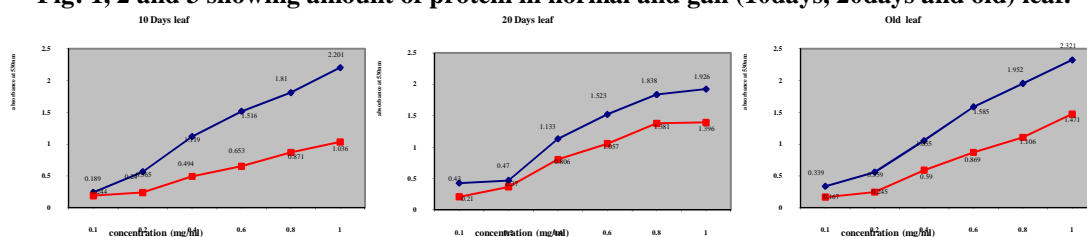


Fig: 4, 5 and 6 showing amount of total auxin contents in normal and gall (10days, 20days and old) leaf.

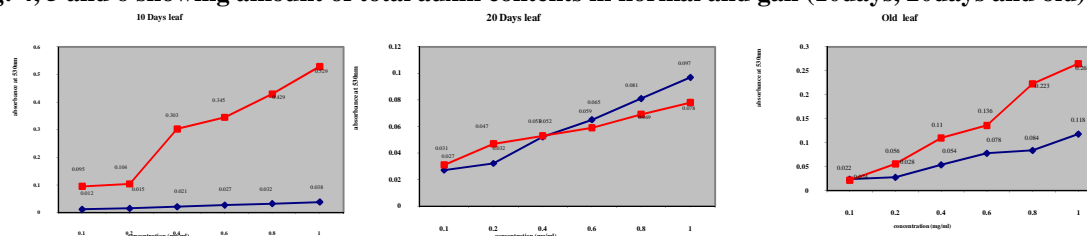


Fig: 7, 8 and 9 showing amount of free auxin contents in normal and gall (10days, 20days and old) leaf.

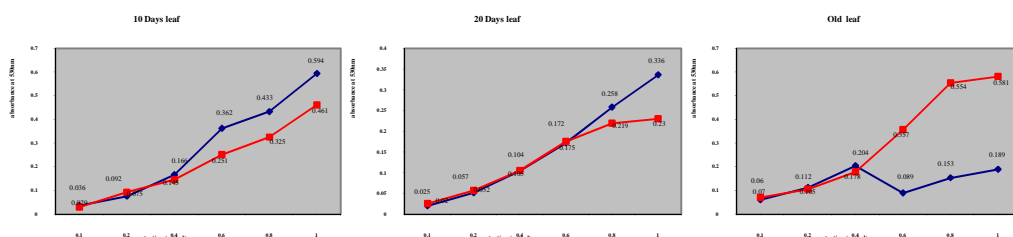


Fig: 10, 11 and 12 showing amount of IAA oxidase in normal and gall (10days, 20days and old) leaf.

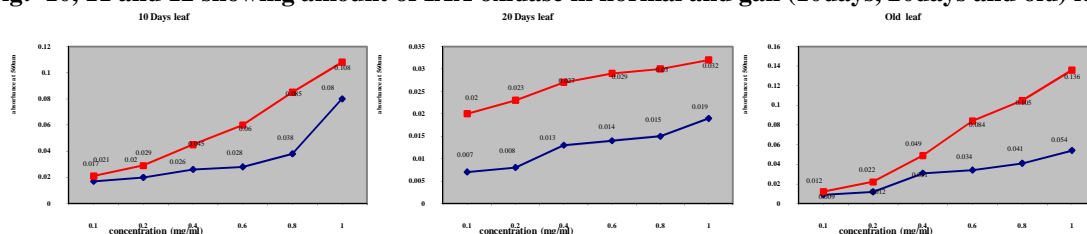


Fig: 13, 14 and 15 showing amount of invertase activity in normal and gall (10days, 20days and old) leaf.

Discussions

The amount of total protein was recorded to be more in the gall tissue as compared to normal tissue. The gall forming insect, its larvae, secretes or induces the production of certain enzymes or enzyme like substances, proteins and growth regulators during gall formation (Parr, 1940; Allen, 1951; Maxwell and Painter, 1962; Schaller, 1965; Carter, 1973; Decleneet *al.*, 1980; Suricoet *al.*, 1984). Since insects derive their nutrition from gall tissue, the gall becomes a sink for different nutrients and energy that will be vital for the insect's growth.

Higher amount of free auxin contents and IAA oxidase was found in the gall tissue as compared to normal tissue. High levels of auxin will cause cell expansion (hypertrophy) and cell division (hyperplasia) in many plants (Sachs, 1961; Jablonski and Skoog, 1954; Nitsch, 1968). In old gall the number of infected larva is rises so IAA contents observed is more amount. Indole-3-acetic acid (IAA), the main auxin in higher plants, has profound effects on plant growth and development. Both plants and some plant pathogens can produce IAA to modulate plant growth. (Zhao,2010). Invertase activity was recorded to be more in gall tissue as compared to normal tissues. Invertases are key metabolic enzymes that involved in various aspects of the plant life cycle and alone or in combination with plant hormones, can regulate many aspect of the growth and development of plants.

CONCLUSION

Since the study was conducted in a controlled manner, the amount of auxin contents were found higher in the galls in which insects were present. This study is preliminary and these results may be useful to check the insect infection on this bio diesel plant to increase the seed production for bio diesel in future. The infected part of the plant can be used as a natural source of auxin content for the growth and development of useful plants.

To conclude the present study, I have found that most of the biochemicals and enzymes were higher in the galls part of the plant as compared to their normal counterpart.

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