PHYTOALEXIN RESPONSE IN *MANGIFERA INDICA* LINN.

CHAPTER - VII

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Mangifera indica Linn. is included among the oldest and most important trees of India. It is under cultivation for the last 6000 years and has more than 1000 varieties.

M.indica is a 15-20 m tall, evergreen tree with light black or blackish brown-rough longitudinally fissured bark. Leaves 9-32 x 2-8 cm, flowers small, numerous, in 10-25 cm long terminal panicles. Drupes variable in size and shape, yellow to reddish yellow when ripe. Seeds 2.5 x 1.4 cm or more in size, oblong, glabrous and smooth.

The ripe fruits of *M.indica* are nourishing sweet and delicious with a characteristics flavour. They are rich in vitamin A, carotenes and sugars. Unripe fruits are used as pickles. Mangoes are also canned in the form of jams. The mango seed oil is used for making soap and is sometimes consumed as edible oil. The wood of *M.indica* is used in the manufacture of plywood and the bark for tanning.

Many medicinal properties are also ascribed to mango. The ripe fruit is considered diuretic and laxative. The kernel is given as medicine to people suffering from asthma and diarrhoea. Baked and sugared pulp of unripe fruit is considered

very useful for cholera and plague patients. The gum of the tree and the resinous substance exuded from the stem are given mixed with lime juice for cutaneous infections and scabies. Butin (7,3'4'-Tri OH flavonone) (Ansari et al.,1967) and tetracyclic terpenoids (Anajeyulu et al.,1985) have been reported from the stem bark of M.indica. Quercetin, kaempferol, mangiferin, 1,3,6,7, tetrahydroxy xanthone, gallic acid and m-digallic acid were reported to be present in the leaves (Elsessi and Salch, 1965) and isoquercetin, kaempferol and leucoanthocyanins from flowers (Bose and Siddiqui, 1948) of M.indica. Singh and Bose (1961) isolated ethyl gallate from alcoholic extracts of mango panicles. Ghosal et al.,(1978) reported, 1,3,6,7, tetraoxygenated and 1,3,5,6,7 pentaoxygenated xanthones, flavonols, depsides, triterpenes and polyphenols from various parts of M.indica. Guha and Chakravarty (1933) recorded Vit B_1, B_2, and Vit C in Indian Mango. The seed fat of M.indica contain 53 percent molecules of saturated acids and the proportions of the di, monosaturated and trisaturated glycerides are 67.5, 25.7 and 6.5 per cent molecules respectively (Narayanan and Kartha, 1962).

Different parts of M.indica are known to suffer from a number of diseases caused by fungi, bacteria and insects. Fungi are the major agents causing the diseases (Laxminarayana and Reddy 1977; Singh, 1970).

In the present work leaves of M.indica having a leaf spot disease was analysed for post infectional changes. The leaf spot disease was found to occur from January to March. Phytoalexin response was also monitored using the fungal pathogen and a non-pathogen.

MATERIALS AND METHODS

Healthy and infected leaves of M.indica were collected from the Botanical garden of the M.S.University of Baroda, Baroda.

The procedures followed for the isolation and culture of the pathogenic fungus, pathogenicity tests, extraction, isolation and identification of compounds and the drop diffusate technique have been described in chapter II.

RESULTS

Aspergillus niger van Tieghem was the fungus isolated from the diseased spots of the infected leaves. Tests confirmed the pathogenicity of the fungus.

The disease symptoms appeared on leaves 7-8 days after artificial inoculation. The lesions due to the disease were scattered on the leaf blade, small in size and brown in colour. The diseased lesions were produced only on the upper surface of the leaf.

Fig.35 Diseased leaves of Mangifera indica Linn.

FIG. 35

The distribution of saponins, tannins, proanthocyanidins, iridoids and alkaloids in healthy and infected leaves of M. indica are presented in Table XII. Alkaloids and saponins were present while tannins proanthocyanidins and iridoids were absent in both healthy and infected leaves of M.indica. The distribution of various phenolics present in healthy and infected leaves of M.indica is presented in Table XIII. Both the healthy and infected leaves of M.indica contained quercetin, quercetagetin, mangiferin and some unidentified compounds. The characteristics of the unidentified compounds are (1) yellow brown in UV : $\lambda \frac{max}{MeOH}$ 238, 262nm , (2) Brown in UV : $\lambda \frac{max}{MeOH}$ 262, 388 nm and (3) Yellow in UV : $\lambda \frac{max}{MeOH}$ 276 nm. Vanillic, syringic and p-hydroxybenzoic acids were also present in both healthy and infected leaves.

There was no qualitative change between the diffusates of the treated and control experiments when leaves of M.indica were exposed to spores of the pathogenic fungus, A.niger. But when a nonpathogen Fusarium solani (Mart.) Sacc. was used to examine the phytoalexin response, mangiferin (xanthone glucoside) was seen leaching out into the treated diffusate.

DISCUSSION

In the present experiment, the chemical constitution of the leaves of M.indica showed no qualitative changes after infection though differences in chemical constitution of M.indica

infected with A.niger and Fusarium monoliformae have been reported earlier (Ghosal et al.,1978). Less intensity of infection and a lack of response of the host plant to the fungal attack could be the major reasons for the unaltered chemical constitution of the leaves infected with A.niger The presence of mangiferin in the diffusate of leaves treated with the nonpathogen, F.solani indicate the possible role of this compound as a phytoalexin. The antifungal activity of mangiferin against Fusarium has already been convincingly proved by Ghosal et al.,(1977). In their experiments they found out that the hyphal walls of F.oxysporum suspended in mangiferin were lysed within 72 hours after addition of mangiferin, the mycelium became black, the protoplasts were contracted and detached from the cell wall and had collected at one corner or in the middle of the cells. Mangiferin also inhibited the production of fusaric acid produced by F.oxysporum. It was also found that the seeds of safflower treated with mangiferin was protected against infection by F.oxysporum. Moreover, Ghosal et al., (1978) reported that mangiferin was present only in traces in normal flowers of M.indica, while in F. monoliformae infected malformed flowers, its amount was very high. Even in healthy twigs, mangiferin occured in minor quantities, while in malformed shoots/twigs infected with F. monoliformae, its concentration was much higher.

The production of mangiferin on treatment with the non-pathogen F.solani and the failure to produce the same against

the pathogen, suggests that the xanthone glycoside offers resistance against the fungus and since mangiferin being anti-Fusarium its response to F.solani appeared to be quite instantaneous and natural. The presence of mangiferin in healthy leaves as reported in this chapter could be the reason why F.solani is not able to infect it. It also appears that mangiferin could be less toxic to A.niger, the pathogenic fungus, therefore the host plant is unable to overcome the fungal attack.

The above results clearly indicate that mangiferin does play a role in disease resistance. Its immediate response to fungal induction and its antifungal activity firmly indicate its role as a phytoalexin.

Table XII : Distribution of tannins, saponins, proanthocyanidins, iridoids and alkaloids in healthy and infected leaves of Mangifera indica.

Leaves	1	2	3	4	5
Healthy	.	+	.	.	+
Infected	.	+	.	.	+

1. Tannins 2. Saponins, 3. Proanthocyanidins
4. Iridoids 5. Alkaloids

Table XIII : Distribution of various phenolics in healthy and infected leaves of Mangifera indica.

Leaves	1	2	3	4	5	6	7	8	9
Healthy	+	+	+	+	+	+	+	+	+
Infected	+	+	+	+	+	+	+	+	+

1. Quercetin 2. Quercetagetin 3. Mangiferin 4.Vanillic acid 5. Syringic acid 6. p-hydroxybenzoic acid 7. An yellowish brown compound in UV light 8. An yellow coloured compound in UV light. 9. An brown coloured compound in UV light.