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POLYPHENOL CONTENT IN COCONUT ROOTS IN RELATION TO (ROOT WILT) DISEASE

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ABSTRACT

Coconut palms in the diseased tract contained less total phenols in the roots as compared to the palms of healthy tract. The N.C.D. variety, which is more resistant than W.C.T., had a low concentration of phenols.

INTRODUCTION

THE implication of phenolic compounds in the defence mechanism of the host is an undisputed factor, since its presence is noticed at the infection and wounding sites (Hare, 1966). The infection of the host tissue is generally associated with an increased synthesis of polyphenols and its oxidation which essentially constitute the mechanism of defence by the host (Kiraly and Farkas, 1962). The oxidation products of the phenols are in fact more toxic to the invading pathogen and the extent of toxicity depends on the stages of oxidation (Farkas and Leadingham, 1959).

In the coconut, Lilly and Ramadasan (1972) observed a significant increase of total phenolics around the site infected by the fungus *Bipolaris halodes* in the leaf rot disease. The characteristic symptoms of root (wilt) disease are discolouration and deterioration of the roots (Menon and Nair, 1949). The vascular discolouration of infected plants are generally attributed to the melanisation of phenolic compounds (Davis and Diamond, 1952). The involvement of polyphenols in the vascular browning of the roots of the root (wilt) affected palms and their relation to the disease have not yet been explored. The results of the preliminary investigations carried out in this direction are presented in this paper.

MATERIALS AND METHODS

Root samples of heathly West Coast Tall (W.C.T.) palms were collected from a heathly area of Kerala and some other root samples were collected from the palms of the diseased tracts. The healthy (Tall × Dwarf) T × D and (Natural Cross Dwarf) N.C.D. palms of CPCRI farm at Kasaragod and Kerala Agriculture University Farm at Nileshwar were also used for drawing root samples. The apparently healthy and diseased T × D root samples were obtained from Ernakulam, Alleppey, Quilon and Kanyakumari Districts. The roots were macerated and the total phenol was extracted with 80 % methanol and estimated with Folin-Ciolcalteu reagent (Spies, 1955).

RESULTS AND DISCUSSION

The total phenolic content was estimated in the samples of roots collected from healthy palms (palms in the healthy tract,) apparently healthy palms (healthy palms in the diseased tract) and diseased palms (both early and advanced) the highest concentration of polyphenols was recorded in samples of roots collected from the healthy palms (Table I). Incidence of disease was associated with a fall in the concentration of total phenols. Statistically, there was a significant difference in the phenolic content between healthy and apparently healthy, healthy and diseased early, healthy and disease advanced, apparently healthy and diseased early and apparently healthy and disease advanced palms. The difference between diseased early and disease advanced was not however significant.

The decrease in the polyphenol content in diseased roots is attributed to a higher rate of oxidation of the polyphenols by the polyphenol oxidase system of the host. Infection by a pathogen can result in the relase of free phenols which are readily converted to toxic oxidation

TABLE I

Mean phenolic content in the root samples of West Coast Tall (W.C.T.) variety

(in mg/100 g dry weight)

No.	Condition of the palm	No. of samples analysed	Mean phenolic content	Influence
1.	Healthy (H) (Kasaragod)	36	130·08	H, A.H.* H, D.E.* H, D.A.*
2.	Apparently healthy (A.H.)	26	92·35	A.H., D.E.* A.H., D.A.*
3.	Diseased (Early) (D.E.)	23	87·35	D.E. D.A.
4.	Disease advanced (D.A.)	21	59·95	

* Significant at 5% level.

products. According to Hodgson *et al.* (1949), the breakdown of the pectic substances of the inner walls of the xylem element may release the free phenols from the cell wall, which are part of the infection phenomenon. Phenolic compounds may be ultimately converted into melanin-like compounds and this may result in vascular browning, a symptom associated with root (wilt) disease. On the basis of the current observation, the apparently healthy palms in the diseased tract containing a comparatively lower concentration of total phenols appear to be in the process of infection.

The variations in phenolic content of the various varieties and hybrids was also investigated in relation to the disease (Table II). In T × D, the trend was about similar to that recorded above for W.C.T. Significant differences were noticed between healthy and apparently healthy, and healthy and diseased palms. The difference was not significant between apparently healthy and diseased palms. The diseased samples in this case had been collected from palms at the early stage of the disease.

An attempt was also made to correlate the phenolic content of the roots in the healthy palms, to resistance to the disease (Table III). Significant differences were observed between T × D and N.C.D., and W.C.T. and N.C.D. No difference was observed between T×D and W.C.T. Among the varieties tested, N.C.D.

TABLE II

Mean phenolic content in the root samples of T × D variety

(In mg/100 g dry weight)

No.	Condition of the palm	No. of samples analysed	Mean phenolic content	Influence
1.	Healthy (H)	32	120·78	H, A.H.* H, D.*
2.	Apparently healthy (A.H.)	34	113·18	A.H. D.
3.	Diseased (D)	20	106·35	

* Significant at 5% level.

TABLE III

Mean phenolic content in the roots of healthy T × D, N.C.D., and W.C.T.

No.	Variety	No. of samples analysed	Mean phenolic content	Influence
1.	T × D	32	120·78	T×D, NCD* NCD, WCT*
2.	NCD	33	81·93	T×D, WCT
3.	WCT	36	130·08	

* Significant at 5% level.

is the most tolerant to the root (wilt) disease (Rawther and Pillai, unpublished, 1972). Resistant varieties are normally characterised by a high content of phenols whereas it is much less in the susceptible varieties (Kiraly and Farkas, 1962). But supporting evidence for the present finding is furnished by Shepherd and Mandrik (1963) in the resistant varieties of *Nicotiana tabacum* which contained less of phenolic compounds than the susceptible ones. Similarly, the varieties of *Linum usitatissimum* resistant to *Melompsora lini* contained less chlorogenic acid than the susceptible variety (Cruickshank and Swain, 1956). The same trend did not however hold good in the case of T ×D variety, which is comparatively more resistant than W.C.T. Further studies are required to arrive at more difinite conclusions in this regard.

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DISCUSSION

MOHANKUMAR : I had observed in tomatoes in my studies on bacterial wilt (*Pseudomonas solanacearum*) resistance that the susceptible varieties had a low tomatin level initially, (2) the resistant varieties had a higher level initially. (3) upon infestation the level of tomatin in susceptible plants further decreased while it went up much above the bacterial level in the resistant plants. I therefore suggest that the different constituents of phenols in coconut may be individually studied in relation to the reaction to root wilt.