SYMPTOMS

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Many of the early records on the symptoms of Coconut root(wilt) disease present ambiguity as they do not pertain exclusively to the disease(Varghese, 1934). Foliar symptoms reported by Varghese(1934); Menon and Pandalai(1958) and Maramorosch(1964) are important diagnostic tool. Diseased palms show paling and conspicuous bending of middle and outer whorls of leaves(Varghese, 1934; Menon and Pandalai, 1958). Radha and Lal(1972) considered flaccidity, the characteristic bending or ribbing of leaflets, to be the diagnostic symptom of the disease. Holmes(1965) pointed out that such affected leaflets are curved along their entire length and form a structure remniscent of the ribs of a mammal. Foliar yellowing and marginal necrosis are observed in association with the disease in adult palms(Menon and Pandalai, 1958). Yellow discolouration of the foliage appears on more than one leaf, some times on a dozen in varying intensities. Parts demonstrating yellow discolouration turn brown and dry up starting from the extremities(Varghese,1934). Yellowing of foliage is virtually absent in young palms where flaccidity is the sole symptom(Radha and Lal,1972).

Expression of foliar symptoms was dependent on the type of soil(Radha and Lal,1972). Flaccidity appeared independently to the extent of one per cent in sandy-loam soil and 23 per cent in laterite. Except for reclaimed soil, yellowing appeared in 2.3 to 15 per cent palms whereas, marginal necrosis was in 0.1 per cent palms in sandy-loam and six per cent in laterite. Sixty seven to 98 per cent palms had flaccidity, 38-76 per cent had yellowing and 28-48 per cent had marginal necrosis, in general. Intensity of these symptoms also varied according to age of the palms. Yellowing was almost absent in palms below the age of ten years. But 96.8 per cent had flaccidity. With advancement in age, necrosis and yellowing assumed prominence. Flaccidity remained consistently high.

Based on their observation on the intensity of flaccidity, yellowing and necrosis on individual leaf, George and Radha (1973) developed a scoring system for quantifying the intensity of coconut root(wilt) disease. Score points have been assigned for each of these symptoms after giving due weightage to the frequency of their occurrence observed in a large number of diseased palms. The stage of the disease viz.early, middle and advanced is decided using separate formulae for young and adult palms. This system is short of perfection as the estimation of intensity on the leaf is based on visual observation but renders the expression of intensity of the disease in simple numerical expression.

Anatomical studies(Joseph and Shanta, 1964) revealed reduction in wall thickness of sclerenchymatous tissue in the leaf and increase in the number of upper epidermal cells, both of which may be contributory to the development of flaccidity. Shanta, Thommen and Menon(1959) reported degenerate chlorphyll perhaps suggesting the reason for the chlorosis.

Dwivedi, Mathew, Amma and Ninan(1979) recorded softening and whitening of the central shoot also as characteristic symptoms of the disease. While softening undoubtedly appears associated with disease incidence whitening may be due to other factors as was pointed out by Varghese(1934).

Menon and Pandalai(1948) reported breaking and premature fall of fronds also as symptoms.

Yield of nuts dwindles gradually. Reduction up to 80 per cent was reported by Radha, Sahasranaman and Menon(1962). Abnormal shedding of female flowers and immature nuts(Menon and Pandalai,1958) and lack of ability to produce female flowers (Varghese,1934) render the palm unproductive.

A high percentage of pollen was sterile (Varkey and Davis, 1960). Meiotic irregularities in diseased palms were observed by Nambiar and Prasannakumari(1964).

Drying up of spathe from tip down-wards was thought as a symptom of the root(wilt) disease(Menon and Pandalai, 1958; Maramorosch, 1964). But Varghese(1934) considered this to be due to other factors.

Inspite of the reported tendency of the stem of the diseased palm to taper or reduce in size(Menon and Pandalai, 1958) no valid observation on stem anatomy was made on account of the quick discolouration that takes place on sectioning and its unusual hardness.

Root damage ever remained controversial. Varghese (1934) observed extensive rot of the root cortex which led the palm to temporary starvation. The roots do not actually rot except when in contact with sub-soil water. Only, some roots may be thrown out of function. Menon and Nair(1949) reported that in palms in the early stage of the disease with visible external symptoms, rotting was confined to the tip of a small number of roots. Nagaraj and Menon(1955) did not find any difference in root damage between apparently healthy and early diseased palms. Although Radha, Ravindran and George(1971) reported occurrence of root rot up to 92.4 per cent due to root(wilt) disease, there are other reports that there was no comparison between the root rot and the foliar symptoms and that the root rot was only secondary (Anonymous, 1966; Radha and Lal 1967; Lal,1969). It is relevant in the context that Maramorosch(1964) failed to observe root rot when fresh holes were dug under the diseased palms. Observation of the authors(Thomas Joseph and Jayasankar) (unpublished) that there is no significant difference in the rate of root rot between the apparently healthy and root(wilt) diseased palms and that the normal rate of root rot in West Coast Tall palms was not more than 10.57 per cent tends to conclude that the root rot is not a characteristic symptom of Coconut root(wilt) disease.

Observation of Michael(1963) that the diseased palm produced lesser number of roots appears not valid as Sampson(1923) found that the root habit of coconut palm varied greatly depending on the nature of the seed nuts used to raise it. More over, total number of roots of a palm is highly variable.

Development of tyloses in xylem vessels of root from diseased palms, degenerate phloem(Indira and Ramadasan, 1968; Govindankutty and Vellaichamy, 1976) are characteristic of the disease. Over 60 per cent of externally healthy roots from diseased palms had internal browning(Anonymous, 1976). Further investigations showed that roots from palms of healthy and diseased categories failed to develop the discolouration in the presence of antioxidant (Dwivedi, Potti, Amma, Govindankutty, Solomon and Jayasankar,1978).

Of all the symptoms flaccidity remains convincingly characteristic of the Coconut root(wilt) disease, yellowing and marginal necrosis assuming an inconsistent part. Root rot has no decisive role among the symptoms of the disease.

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