

**PROCEEDINGS OF THE WORKSHOP ON  
LETHAL DISEASES OF COCONUT  
CAUSED BY PHYTOPLASMA  
AND THEIR IMPORTANCE  
IN SOUTHEAST ASIA**

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## **Root (wilt) and tatipaka diseases of coconut in India**

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India is the largest producer of coconut in the world. During 1994-95 the country produced about 13,231 million nuts from 1.69 million ha with an average productivity of 7,808 nuts per ha. However, wide variation in productivity ranging from 5,000 to 18,000 nuts per ha has been observed within the country. The low productivity is mainly attributed to the so called debilitating root (wilt) disease widespread in the prime producing State, Kerala.

### **Root (wilt) disease**

Root (wilt) disease is reported to have made its appearance in 1879 and became more prominent after the great floods in 1882. The disease was reported from three independent locations at a distance of about 50 km each in Kerala. The disease which appeared more or less simultaneously in three foci began to spread to adjoining areas also. According to a survey conducted during 1984-85 the disease is contiguously present in the eight southern districts of Kerala e.g. Thiruvananthapuram, Kollam, Pathanamthitta, Alappuzha, Idukki, Kottayam, Ernakulam and Trissur and in isolated tracts of northern districts. The disease incidence and intensity varied considerably in different districts, the highest incidence being in Kottayam (75.6%) and lowest in Thiruvananthapuram (1.5%). The annual reduction in yield has been estimated to be 968 million nuts in addition to the loss in the number and quality of leaf, copra weight and oil content. The survey also revealed the occurrence of diseased palm in some isolated pockets in the northern parts of Kerala far away from the diseased tract and also in the adjoining districts of Tamil Nadu.

The root (wilt) disease occurs in all soil types but the spread is faster in sandy loam and alluvial compared to laterite or heavy textured soil. Higher incidence is recorded in water-logged low lying areas near to rivers and canals. The pattern of spread is erratic.

The primary symptom of the disease is the abnormal bending of the leaflets termed ribbing or flaccidity. Yellowing and marginal necrosis of leaflets of the outer whorls are other symptoms.

In seedlings and juvenile palms yellowing is not very common but the primary symptom is the rotting of the spindle [spear leaf] followed by flaccidity but in some cases flaccidity appears first soon followed by rotting of leaflets of the spindle. Root rotting is extensive in affected palms and the capacity of palm to put out fresh roots is reduced drastically.

Shedding of buttons and immature nuts and reduction in the number and size of leaves are often observed. Drying of the spathe and necrosis of spikelets from tip downwards

in unopened inflorescence is noticed in a few cases. The tips of the leaves break, become yellow, hang, dry and then fall off. This is another symptom that occurs in certain palms. Structural changes occurs in vascular tissues. Tyloses are seen in xylem vessels of roots of diseased palms. The disease is non-lethal but debilitating and in the advanced stage the crown is very much reduced in size and produce fewer or no inflorescence. Palms of all age groups are affected. Acquiring the disease at a pre-bearing age delays flowering.

Leaf rot disease caused by fungi occurs superimposed on root (wilt) affected palms. The unopened pale yellow leaflets of spindles alone are susceptible. All subsequent spindles get affected in different intensities which disfigures the crown and caused rapid decline in yield.

Intensive and elaborate studies were conducted to find out the involvement of fungi, bacteria, virus and nematodes in the etiology of the disease but no linkage could be established with any of them.

Researches conducted in the recent past at CPCRI has revealed the consistent presence of phytoplasmas in the tissues of diseased palms and their total absence in the disease free palms. Further support for the phytoplasma etiology was obtained through the successful transmission of the disease by *Stephanitis typica* under insect proof conditions and through partial remission of symptoms in 53% of palms consequent upon the injection of oxytetracycline at 3 and 6 g ai. The phytoplasma could also be transmitted from coconut to periwinkle through dodder laurel (*Cassytha filiformis*) grown in insect proof cages bridged to diseased coconut palms.

Electron microscopic examinations have not revealed the presence of phytoplasmas either in the embryos or pollen grains collected from root (wilt) disease affected palms (CPCRI Annual Report 1987)

A sero-diagnostic test and a physiological test based on stomatal resistance have been standardised for detecting the disease.

Histological staining techniques for detection of phytoplasmas in plant tissue under light microscope also have been standardised. Abnormal blueish colouration in sieve tubes following Dienes staining and specific fluorescing sites in sieve area consequent to staining with DAPI are indicative of the accumulation of DNA in extra nucleolar sites and the presence of phytoplasmas.

Field evaluation of 45 cultivars and 62 hybrid combinations to locate resistance against root (wilt) diseases did not yield any desirable level of tolerance/resistance. Twenty four germplasm collections made from Pacific Ocean Islands in 1981 have come to bearing at CPCRI RC Andamans and they are to be screened against the disease in the coming years. Fifteen germplasm collections were made through embryos from Mauritius, Madagascar and Seychelles in 1997. They also will be screened later against the disease.

Attempts are also being made to develop tolerant lines by identifying disease-free palms, in 'hot spot' areas and utilizing them in the breeding programme, as parents to generate hybrids for retesting in 'hot-spots'.

A total of 200 high yielding disease-free West Coast Tall (WCT) of 35 years and above and 100 Chowghat Green Dwarf (CGD) palms of over 15 years on the basis of

their negative reaction to serological test were selected for breeding programme.

A total of 2,500 seedling progenies of various cross combinations have already been planted on the farm of CPCRI RS Kayangulam. First batch of 31 CGD x WCT hybrid progenies were planted in 1991. They have flowered within 36-40 months after planting and yielded over 100 nuts per palm per year. Twenty percent of them have shown the symptoms of the root (wilt) disease in the eighth year of planting.

Since the disease is not fatal it responds to management practices. The importance of plant nutrition in reducing the incidence and severity of this disease has been recognized. Based on studies, the CPCRI recommended a balanced dose of 500g N, 300g P<sub>2</sub>O<sub>5</sub>, 1,000g K<sub>2</sub>O and MgO per palm per year for the root (wilt) affected areas to maintain the productivity of the palms.

The present strategy developed by CPCRI to combat the disease in the heavily infected contiguous tracts consists of systematic eradication of all palm in the advanced stage of disease and palms infected prior to flowering. Eradication of all the diseased palms is recommended in the mildly affected northern districts.

Economic yield can be obtained from diseased palms by adopting spraying of fungicides against leaf rot, additions of organic matter, raising green manure crops in the basins and inter spaces and their incorporation, irrigation during summer months and adopting inter- and mixed-cropping and mixed farming (Nair *et al*, 1991 and Solomon, 1994).

### **Tatipaka Disease**

The disease made its appearance in Tatipaka village of Razole taluk of East Godavari District of Andhra Pradesh after the cyclone in 1949.

The disease is observed in palms of 20-60 years. Affected palms show extensive root rot and reduced root regeneration. Tapering of trunk and bending of trunk to 'S' shape is common. Leaves are reduced in size and number. They become light green and slowly turn to yellowish green. In some cases the leaflets adhere together without normal splitting giving a fasciated appearance to the leaf. The fronds instead of bending at the tips as in the normal trees, give a bow like appearance due to bending at the middle in many instances and may even get twisted. The dried fronds are usually found hanging below the crown instead of falling. The spathes are very small with few rachillae and produce less number of inflorescence year after year. The bunches contain normal and atrophied nuts or only atrophied nuts and may even become barren. The nuts become more round with soft mesocarp. The atrophied nuts do not contain water, copra and shell. Finally the tree shed yellowed leaves in slow succession and may die.

Electron microscopic examination of tender roots, sub-meristem, petiole of developing leaves and rachilla of tender inflorescence of diseased palms revealed the presence of phytoplasma in sieve tubes. Light microscopy using Dienes's stain, fluorescent microscopy with aniline blue as fluorochrome corroborated the findings of electron microscopy. Remission of symptoms observed in diseased palm treated with tetracycline hydrochloride further confirmed the phytoplasma etiology of the disease.

Resistance has been noticed in the dwarf cultivar Gangabondam which is a good parent for production of hybrids.

Attempts to control the disease by foliar and soil application of various chemicals, hormones and nutrients did not yield any encouraging results. Root regeneration of affected palms also could not ameliorate the condition of palms.

Since there are no prophylactic or curative measures available for treating phytoplasma diseased plants, the option left are to arrest the spread of disease by systematic surveillance and roguing of diseased palms as and when identified and breeding for disease resistance. The programme of identifying the diseased palms and eradication is a more practical step in this disease as the number of diseased palms are comparatively very low and the spread is reported to be very slow. The programme, if systematically implemented, will help in total eradication of the Tatipaka disease from the State of Andhra Pradesh.

Eradication of affected palms totalling 8,179 in Razole, Allavaram and Malkipuram mandals is to be completed which constitutes about 87% of the total palms diseased. Further monitoring of incidence of disease and their eradication will be carried out in this area continuously (Rajamannar, *et. al.* 1994).

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