

Rapid Decline Syndrome of Coconut – Preliminary Report of a New Condition

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Coconut Rapid Decline (CRD) is a recently recognized disorder of coconut palm (*Cocos nucifera* L.) in Sri Lanka. It reduces the yield in 6–8 months and kills the palm within 2–3 years from the appearance of first leaf symptoms. About 750 palms are known to have succumbed to the disorder from 1997 to date. CRD has a unique symptom expression that differs from other reported diseases of the coconut palm. This paper details the symptoms of CRD.

The coconut palm (Fig. 1) is prone to several diseases and disorders that cause a substantial consequent loss of crop. Coconut Rapid Decline (CRD) is a recently recognized disorder of coconut in Sri Lanka. It was first observed in 1997 at Makandura Seed Garden (MSG) of the Coconut Research Institute (CRI), which was planted with improved cultivars (Tall × Tall and Ambakelle Special) of Sri Lankan tall variety. Both cultivars were equally affected by CRD. A few months later, the same symptoms were reported at Bandirippuwa Estate (BE) Lunuwila and some private estates that were planted with improved tall cultivar, in the Puttalam, Kurunegala and Gampaha districts.

The syndrome could generally be seen in palms between 15–35 years of age. Although the precise duration of the different phases of the disorder have yet to be determined, it appears that the yield is reduced in 6–8 months and the palm killed within 2–3 years from the first appearance of leaf symptoms. According to surveys conducted by

the CRI, about 750 palms in the MSG and BE have succumbed to the disorder from 1997 to date.

Symptomatology

Leaf canopy

The most characteristic visual symptom of the syndrome is a drooping or hanging down of the middle and lower canopy of green fronds (Figs 2–4). In some instances, petioles of the fronds in the middle canopy break at varying lengths from the base. These drooping or broken fronds dry up rapidly leaving only a few erect fronds in the crown. With the progress of the disorder, the number of healthy fronds in the canopy reduces, leaves turn pale green and emerging fronds become shorter, resulting in a drastic reduction in the size of the crown. In the severe stage, scorching of the tips of leaflets can be observed (Fig. 4). Finally, the dried fronds drop leaving a crownless coconut trunk. However, the expression of foliar symptoms can vary from palm to palm.



1 (left). Healthy palm. 2 (right). CRD-affected palm, incipient stage.

Trunk

With the initial drooping symptoms, the trunk begins to taper and the internode length progressively reduces. With the progress of the disorder, a marked constriction of the trunk just below the crown can be observed. No abnormalities in the internal tissues of the trunk of affected palms were observed at any stage of the syndrome.

Inflorescence and nut development

The CRD syndrome also affects the reproductive system of the palm. The inflorescences that emerge during the initial stages of symptom development are shorter and thinner (Fig. 5) but the number of female flowers therein is similar to that of a healthy inflorescence. With the progress of the syndrome, the palm sets progressively fewer nuts resulting in a gradual yield decline. Further, as a result of the reduced internode length, the emerging inflorescences are arranged closer together, giving a 'rosette' like appearance to the crown. Inflorescences without any nuts (empty bunches) are also a common symptom of moderate to severely affected palms (Fig. 6, 7). In

the severe stage, the developing nuts become smaller and elongated resulting in a lower kernel weight compared to healthy nuts (Figs 8). Immature nut fall is not associated with this syndrome. Germination of the mature nuts of CRD-affected palms is comparable with that of healthy palms.

Roots

No abnormalities were observed in the root system. But the formation of new roots following a rainy season was found to be less in rapid decline-affected palms as compared to healthy palms.

Occurrence and Distribution

The distribution of affected palms is mapped through observations at six monthly intervals to determine the pattern of spread at Makandura Seed Garden (MSG) and Bandirippuwa Estate (BE) of the Coconut Research Institute. Seven surveys have been conducted since 1997 and, according to the latest survey in May 2001, there has been an appreciable increase in the incidence at MSG and BE during the past 6 months (Table 1) and the



3. (left) CRD-affected palm, moderate stage. 4 (right). CRD-affected palm, severe stage.

distribution is patchy. During the years 2000 and 2001, a few more private estates were also reported to have CRD affected palms.

Etiology

The cause of the disorder is still unknown. The first decision that needs to be made is whether the disease is abiotic or biotic. At present, experiments are in progress to determine the effects of nematicide, fungicide, tetracycline and micro-nutrient treatments on disease progress. Investigations were commenced in collaboration with Adelaide University, Australia and support by FAO to determine whether the CRD is associated with phytoplasmas or viroids. DNA sequencing techniques are being employed for phytoplasma detection, and detailed analytical

work is in progress to detect viroidlike-sequences in the trunk, leaf and inflorescence tissues of the affected palms. If the CRD is biotic, it has the potential to create an epidemic by spreading. Therefore, it is of utmost importance to identify the cause of Coconut Rapid Decline syndrome as a priority and to establish appropriate control procedures as early as possible.

Discussion

Rapid Decline (CRD), Leaf Scorch Decline (LSD) and tapering disease (TD) of coconut in Sri Lanka: a comparison

The symptoms of CRD are distinct from previously reported 'diseases' such as LSD (Rajapakse & Fernando 1995, Mahindapala & Chandrasena

Table 1 : Incidence of CRD at MSG and BE (survey data of May 2001)

Estate	Total number under observation	Total number of affected palms	% Affected	Increase during Nov 00–May 01
BE	5377	171	3.18%	110
MSG	6350	568	8.96%	288



5. Fully matured inflorescences of healthy and CRD-affected (incipient and severe) coconut palms.



6. Appearance of nuts at different stages of development (a representative nut for each stage) – healthy palm: front row from R to L: 1st – 9th bunch, middle row from L to R: 10th – 15th bunch, back row from R to L: 16th – 21st bunch.

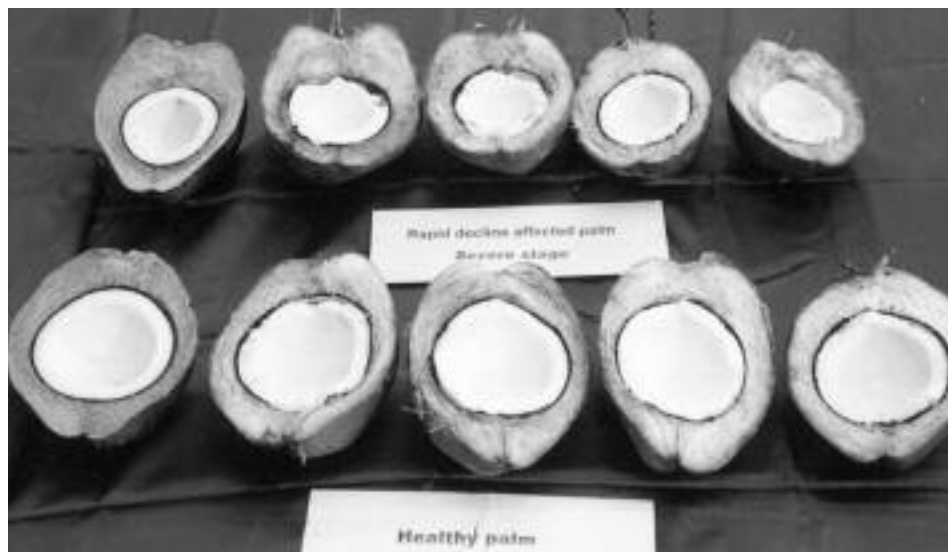


7. Appearance of nuts at different stages of development (a representative nut for each stage) – severely affected palm: front row from L to R: 1st – 7th bunch (note the empty bunches 3rd, 4th, 5th and 6th) back row from R to L: 8th – 12th bunch.

1975, Gunasekara et al. 1973, Perera 1971, Humphries 1970, Ekanayake 1968, Peries 1968, Maramorosch 1964, Davies 1962) and TD (Cooke 1950, Cooke et al. 1950) of coconut. The cause of all three disorders is still unknown.

The most striking visible symptom of LSD-affected palm is the scorching of leaflets starting from the tip and advancing towards the mid rib of the frond, accompanied by a slight curling, and progressing from the lower to the middle whorl fronds (Rajapakse & Fernando 1995). In TD-affected palms, the characteristic symptom is the pale green color and asymmetrical canopy sub-

sequently diminishing the size due to shortening of the newly formed fronds (Cooke 1950). The drooping of middle and lower canopy of green fronds, as observed in CRD, is not a characteristic of the above two syndromes. This is an important distinction between CRD and other two disorders. Tapering of the trunk just below the crown occurs fairly rapidly in TD-affected palms whereas in the LSD and CRD-affected palms it is observed only in the advanced stage (Rajapakse & Fernando 1995, Cooke 1950). In the aspect of root characteristics CRD is completely different from LSD and TD, where root decaying is very high in the affected palms (Davis 1962, Cooke 1950).



8. Split nuts of healthy and CRD affected coconut palms. Front row: mature nuts of a healthy palm; back row: mature nuts of a severely affected palm.

All three disorders have a very striking similarity with regard to the size of the inflorescence, nut set, nut yield and shape of nuts in the advanced stage. Similarly, all three disorders are seen in the coconut palms above 15 years of age.

There is a remarkable difference in the pattern of distribution between CRD and the other two disorders. LSD- and TD-affected palms show a scattered distribution and slow spreading pattern whilst CRD shows a patchy distribution and appreciably rapid spreading pattern. This appears to indicate that the CRD is transmissible but that LSD and TD are not such 'diseases' (Humphries 1970, Davis 1962, Cooke 1950). Nevertheless, in LSD and TD, death of the palm is much delayed (6-10 years or more) but in CRD killing occurs within 2-3 years.

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