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EVIDENCES FOR TRANSMISSION OF YELLOW LEAF DISEASE OF ARECA PALM, *ARECA CATECHU* L. BY *PROUTISTA MOESTA* (WESTWOOD) (HOMOPTERA: DERBIDAE)*

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The arecanut palm, *Areca catechu* L., occupies a prominent place among the cultivated crops in the states of Kerala, Karnataka, Assam, Meghalaya, Tamil Nadu and West Bengal and is of considerable economic and socio-religious importance for the entire country. India is the largest producer of arecanut contributing to 88% of the world production. In recent years, arecanut production registered a steep decline in field due to Yellow Leaf Disease (YLD). The disease is rampant in the Central and Southern Kerala while in the Northern Kerala and Karnataka, many gardens are affected by the disease in pockets.

The symptoms of the disease has been well described by earlier workers (Menon, 1963; Rawther, 1976; Nayar & Seliskar, 1978). Nayar (1971, 1976) reported that the causal organism is possibly Phytoplasma (earlier known as Mycoplasma- like organisms (MLOs)). Electron microscopic studies (Nayar & Seliskar, 1978; Seliskar & Wilson, 1981) showed the presence of Phytoplasmas in the young sieve elements of YLD affected areca palms in Kerala and Karnataka. Histological staining techniques employing Dienes' stain and pleurochrome DAPI for visualising Phytoplasma under optical microscopy lent further support (Anon, 1985). Constant association of Phytoplasma with the disease has been established with the finding of the organism in tissues of diseased palms and their absence in palms from disease free area.

Since Phytoplasmas are generally transmitted by leafhoppers and planthoppers (Maramorosch & Harris, 1979) emphasis was given to identify insects under this group as potential vectors. An inventory of insects in YLD affected gardens revealed the constant association of *Carvalhoia arecae* M & C (Hemiptera; Miriidae) and *Proutista moesta* (Westwood) (Homoptera: Derbidae). Another Planthopper, *Oliarus* sp. (Homoptera: Cixiidae) was also occasionally found (Anon, 1984). Earlier studies have proved that *C. arecae* is not a potential vector (Jacob, 1990). The ability of the planthopper *P. moesta* to acquire and sustain the mollicutes was assessed. On EM examination Phytoplasmas were observed in the salivary gland tissues of planthoppers subjected to 30-41 days' acquisition and incubation period on YLD affected areca palms while Phytoplasmas were totally absent in the salivary glands of laboratory reared planthoppers as well as insects collected from healthy area (Ponnamma *et al.*, 1991). This paper discusses further evidence accrued on the vector role of *P. moesta* gained through transmission studies.

Transmission studies were initiated with one-year old (Variety South Kanara) arecanut seedlings obtained from disease free area (CPCRI, RS, Vittal) and seedlings were given a prophylactic spraying using monocrotophos 0.1% and planted in circular cement pots of 75cm diameter and 60cm height filled with steam sterilized pot mixture. The seedlings were kept under insect proof condition using individual iron cages (315cmx150cm) covered with nylon net (1cm=40 mesh). Two plastic zips (15cm) were fitted on either side of the cage for releasing the planthoppers and also for

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examining the seedlings. Small pots (15cm diameter) filled with breeding material (steam sterilized), decaying male and female inflorescences of oil palm, were kept for facilitating egg laying in the experimental cages excluding check to ensure normal physiological activities. The same was removed and replaced at periodic intervals. The six cages each under treatment and control were kept one metre apart in an alternating fashion.

Field collected adult planthoppers were released in batches of 100 on the tender leaves of YLD-affected areca palms in the field. The leaves were enclosed in nylon net cages (60cm x 45cm). After five days' acquisition feeding period, the planthoppers were recaptured and caged on mature leaves of apparently healthy areca palms to obtain 25 days' incubation period. Initially planthoppers having 30 days' A+IP were released into experimental insect proof cages in which test areca seedlings were kept. Subsequently, planthoppers having 5 days' acquisition access on YLD affected areca palms were released on test areca seedlings. The details of inoculations are furnished in Table 1. Large number of insects were used for inoculation to increase the chances of introducing infective insects under conditions that favoured transmission. The inoculation was started in May 1987 and was continued upto December, 1989. The seedlings in the cages were maintained as per normal package of practices and were inspected frequently to check the survival of released planthoppers and for disease symptoms.

Root samples were collected twice in a year, from all the seedlings under inoculation and control for light microscopic as well as Electron microscopic examination to check the presence of Phytoplasmas in the test plants.

Out of the six seedlings receiving the infective insects, three seedlings showed characteristic foliar yellowing of YLD by December 1989, thirty months after the start of inoculation. Free hand sections of the root tissues from the seedlings stained with Dienes' stain showed positive staining reaction indicating the presence of Phytoplasmas. Electron microscopic examination of ultrathin sections of root apices revealed the presence of Phytoplasmas in the sieve tubes of one seedling. The seedling had by then received 1,274 planthoppers each. By September 1990, thirtynine months after the start of experiment the other three seedlings also started showing characteristic foliar yellowing of the disease. All the seedlings were again sampled during October 1990. Phytoplasmas were located in

Table-1: ***Number of Planthoppers inoculated on healthy arecanut seedlings under insect-proof conditions.***

Date		Number of Plant hoppers released 1	2	3	4	5	6	Total
1987*	i	353	233	243	263	283	205	
	ii	375	375	375	375	375	375	
1988	i	474	582	596	562	543	645	
1989	i	82	165	60	167	182	44	
Total	i	909	980	899	992	1008	894	
	ii	375	375	375	375	375	375	
Grand Total		1284	1355	1274	1367	1383	1269	7932
Average per Seedling								1322

*i. Insects with 5 days' acquisition were released.
ii Insects with 5 days' acquisition plus 25 days' incubation were released.

five out of six *P. moesta* inoculated seedlings. However, none of the control seedlings showed any symptoms or had the phytoplasmas in the tissues.

Systematic enumeration of insects associated with areca palms revealed constant association of *Proutista moesta* with areca palms (Anon, 1984). Survey of representative YLD affected areca gardens in different districts of Kerala revealed that the plant hopper was present in all the diseased gardens (Ponnamma, 1994). Thus, there is no disease occurrence independent of the planthopper. Presence of phytoplasma in salivary glands of planthoppers offered 5 days' acquisition access to diseased palms and 25-36 days incubation period indicated its ability to acquire, sustain its multiplication and act as potential vector of the disease. Location of phytoplasmas in five out of six insect-inoculated seedlings and the symptoms observed thus confirmed transmission of the disease and vector role of the planthopper. The uninoculated control plants were free of symptoms and also did not contain phytoplasmas in sieve tubes. Ploaie (1981) remarked that the presence of phytoplasmas in the insect vectors and the plant to which disease is transmitted by them and the absence of organisms in healthy ones is a convincing evidence.

The above results lend support to the phytoplasma etiology of YLD of arecanut. The vectoral role of *Proutista* is proved with the demonstration of positive transmission of the disease employing this planthopper.

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