

1/250,000 inch). The match stick would contain ca. 1,600,000 sections of this size, and optimistically one section might be cut and then examined with an electron microscope every 20 minutes. At this rate it would take one person, working day and night, over 58 years to give a cursory examination to all the sections from that single match.

Considering the low concentration and unpredictable localization of MLO within palms affected by LY, as well as the limitations of electron microscopy, testing for LY infection is presently an arduous procedure. However, even with its limitations, electron microscopy will continue to be indispensable for LY diagnosis until simpler techniques are developed.

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ATTRACTIVENESS OF DATE AND COCONUT PALMS TO MYNDUS CRUDUS AND OTHER HOMOPTERANS¹

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Abstract. Leafhoppers and planthoppers (Homoptera: suborder Auchenorrhyncha) were sampled by sticky traps placed in mature coconut palms, *Cocos nucifera* L., and date palms, *Phoenix* spp., (Mostly *P. canariensis* Hort ex Chab.) in street plantings in southeastern Florida, and by making counts of insects resting on young coconut and young date palms, *P. dactylifera* L. in an experimental planting in Fort Lauderdale. *Myndus crudus* Van Duzee (Cixiidae) was relatively more abundant in traps in mature coconut and date palms in street plantings compared with other Auchenorrhyncha. No statistically significant difference was found between the numbers of *M. crudus* attracted to these 2 palm species. *Idioderma virescens* Van Duzee (Membracidae) was second in abundance, followed by unidentified species of Cicadellidae. When true date palms of 4 varieties ('Deglet Nour', 'Theory', 'Halawy', 'Zahidi') were sampled by ocular examination on 6 different days during warmer months, auchenorrhynchous insects were nearly absent, while an average of 22.5-38.1 *M. crudus* were counted on young 'Jamaica tall' and 3 different color forms of 'Malayan Dwarf' coconut palms planted in the same grove with the dates. *Cedusa inflata* Ball was also on the coconut palms. The results of sampling from mature trees strengthens the hypothesis that *M. crudus* may be a vector of lethal decline of date palms. The reason for the near absence of *M. crudus*

and other Auchenorrhyncha from young true date palms is not known. The testing of varieties in field plantings for resistance to lethal declines may be prolonged because vectors may not feed on young date palms frequently enough to transmit disease.

In Haiti more than 30 years ago, date palms, *Phoenix dactylifera* L., were affected by a disease that was suspected to be co-identical with lethal yellowing (LY) of coconut palms, *Cocos nucifera* L. (5). The evidence for the co-identity of these 2 diseases was the similarity of the symptoms and the proximity of the affected date palms to LY-infected coconut palms. In the LY affected areas of Florida, lethal declines that are apparently co-identical with LY affect 4 species of date palms, viz., Canary Island date palm, *Phoenix canariensis* Hort ex Chab.; true date palm, *P. dactylifera*; Senegal date palm, *P. reclinata* Jacq.; and India date palm, *P. sylvestris* (L.) Jacq. (9).

Recently, an apparently co-identical disease affecting Canary Island and true date palms was discovered in the Rio Grande Valley of Texas (7). An association with mycoplasma-like organisms (MLO) has been shown for LY and for the date palm lethal declines in Florida and Texas, and for many other palm species in Florida (7, 9). In this report, the term LY will refer to coconut LY and the MLO-associated lethal declines of other palm species.

LY has been known since the 1870's or earlier (6, 8), but prior to 1980 had not been reported outside of coconut growing areas. In LY-affected areas of the Caribbean and Africa, LY of palms other than coconut has not been reported or has received scant attention. In Florida, coconut was apparently the first species affected or observed, after which the disease apparently spread to or was seen in other palms (2). Thus, prior to the recent outbreak of LY in Texas, LY research has concentrated on the disease in coconuts.

The Texas situation raises the possibility that LY could extend into northern Florida and other Gulf Coast states where ornamental date palms are grown in the absence of coconut palms. Also, ornamental palms and commercial

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date regions in southern Arizona and California seem threatened.

Two questions of immediate importance are, 1, how is LY spread to date palms, and 2, can host plant resistance be found in date palm varieties. Evidence from a transmission experiment (4) indicated that a planthopper, *Myndus crudus* Van Duzee (Homoptera: Cixiidae) transmits LY to the Manila palm, *Veitchia merrillii* (Becc.) H. E. Moore. It is suspected that *M. crudus* is the vector of LY to additional palm species because it has been collected from most of the susceptible palm species (3).

In this study we conducted tests to determine the relative abundance of *M. crudus* on date palms as compared to coconut palms, since the status of an insect as a suspected disease vector may depend to some degree on its abundance on the affected plant. We sampled from mature palms, which are apparently more susceptible than younger palms, although the relationship between age of palms and their susceptibility to lethal declines has not been adequately investigated. In addition, we sampled from young palms in a lethal decline resistance evaluation planting, since the success of these trials will partly depend upon the degree to which vectors feed on the palms.

Materials and Methods

Mature palms in street plantings. Single trunk date palms that we identified as *P. canariensis* "type" were selected that were healthy, about 3-5 m in trunk height, and within

about 100-400 m of a coconut palm (Fig. 1). The natural ranges of different *Phoenix* spp. isolate them geographically, but when species of the genus are planted in the same locality, as in Florida, they readily intergrade through hybridization (1). Ornamental date palms with relatively thick single trunks are considered to be *P. canariensis*, but may sometimes be that species crossed with *P. sylvestris*, *P. dactylifera*, or some other species of the genus. Each location selected with a date and coconut palm was about one km or more from another location with a similar planting. There were 5 locations in Broward County, 5 in Dade County, and 6 in Palm Beach County. Insects flying among palm fronds were sampled by stapling two 20 X 20 cm transparent polyethylene sheets opposite to each other over the upper and lower surfaces of a frond, spreading an adhesive, Stikem (Michel & Pelton Co., 5743 Lardiegan St., Emeryville, Ca 94608), over the exposed surfaces of the sheets, and collecting the insects trapped in the adhesive 30 days later (Fig. 2). Sampling was in July (Broward County), and August - September 1980 (Dade and Palm Beach Counties).

Variety Evaluation Planting. A grove of true date palms was planted from offshoots at the Ft. Lauderdale ARC in October 1979. The palms were an average height of 81.8 cm (ground surface to tip of tallest leaf) in April 1980 and had increased to an average height of 137.1 cm in September. Those sampled for insects were of the following varieties (number of plants following each variety): 'Deglet Noor' 3, 'Halawy' 6, 'Zahidi' 6, and 'Thoory' 1. The date palms were planted among Manila palms, *Veitchia merrillii* (Becc.) H. E. Moore, *Pritchardia* spp. of mixed ages, and coconut palms that were Ca. 4 years old and were Ca. 3-4 m tall and of the following varieties: 'Jamaica Tall' 6, 'Golden Malayan Dwarf' 5, 'Green Malayan Dwarf' 7, and 'Yellow Malayan Dwarf' 2 (Fig. 3). The total number of auchenorrhynchous insects was counted on each palm. The counts on all palms were completed within a 90 minute period. This sampling was repeated on 6 different days 2-4 weeks apart during June through September 1980.

Results and Discussion

Mature Palms in Street Plantings. Based on trap catches, *M. crudus* appeared to be attracted to the large date palms in street plantings as well as to nearby coconut palms. There was an average of 42.0 (range 1-541) *M. crudus*



Fig. 1. Typical insect sampling location in Palm Beach County with date palm in foreground, coconut palms left background, and queen palms in right background.

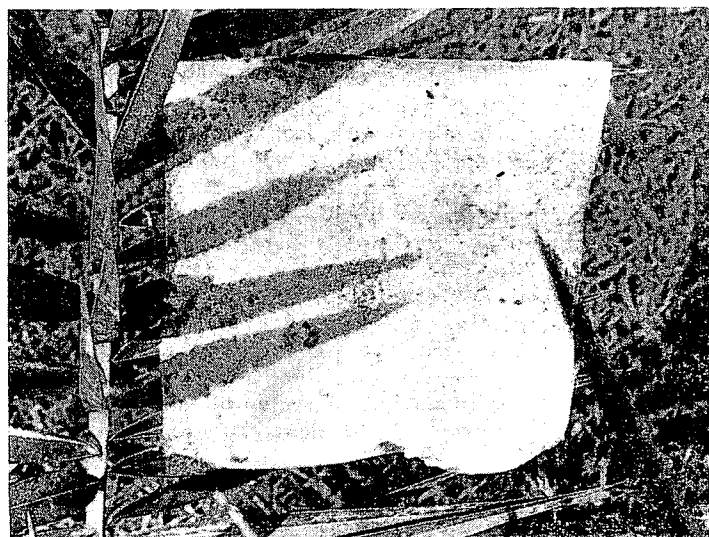


Fig. 2. Sticky trap placed on upper surface of date palm frond. A similar trap was placed opposite on lower frond surface.



Fig. 3. Variety evaluation planting at the Fort Lauderdale ARC, with date, coconut, and Manila palms shown.

captured per trap in the date palms and 11.2 (0-59) per trap in coconut palms. The difference between these averages was not significant even at the 0.3 level of probability (ANOVA).

The second-most common auchenorrhynchous insect in traps was *Idioderma virescens* Van Duzee (Membracidae). However, there were very few of these. A total of 7 were in traps on coconut palms, and 9 in traps in date palms. There was a total of less than 10 specimens of Cicadellidae in too poor condition for identification, and in 1 date palm 18 *Umbonia crassipes* (Amyot and Serville) (Membracidae) were captured.

Date Palm Variety Evaluation Planting. We have rarely observed *Myndus crudus* on the date palms in the variety planting although hundreds of this species per day are routinely collected from coconut palms in the same grove. When actual counts of the total numbers of *M. crudus* were made on 6 different days, the average *M. crudus* per palm was as follows: coconut varieties: 'Jamaica Tall' 22, 'Golden Malayan Dwarf' 26, 'Green Malayan Dwarf' 38, 'Yellow Malayan Dwarf' 25; true date palms: 0.1 or less on each

variety. There was an average of 0.8 *Cedusa inflata* (Ball) per coconut palm, and none of this species on true date palm. The palms in the grove were examined about twice a week in connection with other experiments, and we have observed very few auchenorrhynchous insects on these palms other than *M. crudus* and *C. inflata*.

Cases of coconut LY and lethal declines of other palms were observed in all of the areas sampled in this study. Together with the evidence that MLO-associated lethal declines of palms in southeastern Florida are co-identical with coconut LY (9) and the evidence that *M. crudus* is a vector of LY to Manila palm (4), the prevalence of this insect on mature date palms in areas affected by these diseases (this study) makes it suspect as a vector of LY of date palms.

It may be that the apparent unattractiveness of the young date palms to auchenorrhynchous insects was related to age or size, or the high degree of attractiveness of the nearby coconut palms. Mature true date palms are highly susceptible to LY (2). Experiments are being initiated to determine whether *M. crudus* will feed on young date palms and transmit MLO's to them. If this could be accomplished in transmission cages, it could lead to a method of searching for LY resistance that would bring earlier results than testing by field plantings.

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GROWTH STIMULATION OF CITRUS, ORNAMENTAL, AND VEGETABLE CROPS BY SELECT MYCORRHIZAL FUNGI¹

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Abstract. Mycorrhizal plants, including citrus, tomato, peach, chrysanthemum, and podocarpus showed increased

vegetative and reproductive growth in a greenhouse study. Citrus rootstock (cv. 'sour orange') shoot height and total dry weight and tomato (cv. 'Walter') fruit yields were increased 200-300%. Peach (breeding line 3-123N) shoot height was improved 25-75%, chrysanthemum bloomed earlier and the number of flowers was increased up to 100%, and podocarpus shoot height was increased slightly. Inoculations with *Glomus etunicatus*, *G. fasciculatus*, and *G. mosseae* provided, the greatest growth improvement to the majority of crop species, however, *G. epigaeus*, *G. macrocarpus*, *G. microcarpus*, and *Gigaspora margarita* were beneficial to plant growth on certain hosts. All crops benefitted from at least one mycorrhizal fungal species, but maximum growth response resulted from specific plant-fungus combinations.

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