Spiroplasma citri - discovered 1969; cultured 1970; named 1973.

Professor J. M. Bové and I cooperated in the study of graft-transmissible citrus diseases beginning about 1960. I provided considerable indexed diseased material that I had selected at Riverside since the 1950s, especially of budlines containing only the citrus stubborn pathogen, long considered to be a virus. The USDA also cooperated in the study of stubborn and some other citrus diseases.

The attached documents relate some of the events and developments leading to the discovery that the citrus stubborn pathogen is not a virus, but a spiroplasma, and to subsequent publication of the findings. Note especially the hi-lited portions of the numbered documents.

Professor Bové visited the western United States in the summer of 1969. While he was our guest at Riverside, I showed him how my (then) graduate student, E. C. K. Igwegbe, had for the second time suppressed the symptoms of stubborn disease by tetracycline-HCl treatment. Igwegbe next found the mycoplasma-like bodies in the sieve tubes of diseased citrus leaves in November 1969 while Professor Bové and I were in Japan. He presented his results at a dissertation seminar here in Riverside on March 9, 1970 (See Document #1). Mlle. D. Laflèche obtained the same results in France with material of California origin. The stage was obviously set for culturing attempts.

I assigned the task of culturing the pathogen to Dr. A. E.-S. A. Fudl-Allah, my former student, who was very familiar with citrus stubborn disease. Then, at Professor Bové's invitation (Document #2), I stopped in Paris and on April 1, 1970, we visited a citrus area near Beni Mellal, Morocco where many sweet orange trees were severely affected by stubborn disease (Document #6). I also discussed with Dr. Bové the release of information regarding the apparently mycoplasmal nature of citrus stubborn disease and its inclusion in a newsletter for the International Organization of Citrus Virologists (IOCV) membership (Document #3). At that time Dr. Bové was chairman and I was chairman-elect of that organization.

Soon after I returned to my laboratory Dr. Fudl-Allah had everything ready to attempt isolation of the MLOs that Igwegbe had found in sieve tubes of stubborn citrus.

The first attempt, on May 19, 1970, failed completely. It was at that time that Dr. K. Maramorosch visited us to give a seminar on mycoplasmas including their culture (Document #3A). The second attempt, on May 22, 1970, succeeded in two plates (Document #11), but we lost that culture when we tried to transfer it. After reviewing the situation carefully, we succeeded more easily on June 9, 1970 and started making photographs and expanding the scope of the study. That is the same month that P. Saglio and coworkers achieved their notable success (Document 11). It was too late for us to submit an abstract for the national meeting of the American Phytopathological Society (APS) to be held at Little Rock, Arkansas early in October 1970. However, Dr. Maramorosch had arranged a special discussion session on mycoplasmal diseases of plants for October 6, 1970 and invited me to present the findings regarding culturing of mycoplasmas from diseased citrus. I gave an illustrated oral report (met by considerable skepticism) but my slides were never returned to me (Documents 11 and 12). This was the first report of culturing the alleged stubborn mycoplasma presented to any scientific group in this country.

In September of 1970, Professor Bové informed me that his group had in vitro cultures of stubborn mycoplasma, including cultures from diseased sweet orange seedlings that I had sent him (Document #4). I quickly replied that we also had obtained cultures, as early as May 22, and had been successful even on collections from the orchard but that we could not publish as rapidly as he could (Document #5). We exchanged information on media and Dr. Bové replied that they had made good progress in cultivating a Morocco strain from row 8, tree 5 at Gontar's place near Beni Mellal (Document #6).

Having been invited to provide information on recent developments in the etiology and control of stubborn disease of citrus for the Second International Symposium on Plant Pathology at New Delhi Jan. 27-Feb. 3, 1971, I included a statement that at Riverside we had found MLOs in the sieve tubes and had cultured similar bodies from slices of affected tissues (Document #7). This early 1971 abstract is, I believe, our first published statement that we had actually cultured this microorganism.

Then, on June 22, 1971, I read a paper by Fudl-Allah et al. at the Pacific Division meetings of APS in Hilo, Hawaii and the submitted abstract was published (Document #8) in Phytopathology in November, 1971. The full manuscript was mailed to Phytopathology on August 10, 1971. Three months later we had heard nothing from Phytopathology so I wrote (Document #9) to inquire about this manuscript and another. The APS Editorial Office had been moved soon after we mailed the manuscripts, so neither paper was seen again. We resubmitted them, having lost perhaps 4 months, and they were promptly edited but one reviewer thought we were merely repeating work done previously (Document #10). My cover letter to the Editor-in-Chief (Document 11) summarized the situation and the article was published in July, 1972.

We obviously needed a means of speedier publication of highly significant findings. Subsequently, until I retired in 1980, my colleagues and I sometimes relied on California Agriculture (a University of California publication) to reduce the delay in publication of important information regarding citrus stubborn disease, its pathology, natural transmission and ecology, including non-citrus hosts of S. citri.

If desired, this material may be placed in the I.O.M. Archives.

E. C. Calavan

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September 3, 1986