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Consultancy on
Phytophthora Diseases on Black Pepper and Other
Plantation Crops in South India
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OBSERVATIONS ON RESEARCH ON PHYTOPHTHORA DISEASES
OF BLACK PEPPER AND OTHER PLANTATION CROPS
IN SOUTH INDIA

A report by

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to

Indian Council of Agricultural Research

and

Winrock International Institute for Agricultural Development

and

U.S. Agency for International Development/India

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This report was written at the end of a two-week consultancy (16 October to 3 November, 1988) to the Government of India arranged and financially supported by the Indian Council of Agricultural Research, Winrock International, and USAID/India. The objectives were to observe and advise on the research on Phytophthora diseases on black pepper, arecanut, cocoa, cardamom and some other plantation crops in the state of Kerala and Karnataka, and to participate and present a guest lecture at the International Workshop on Wilt Diseases of Black Pepper in Panaji, Goa. Because of flight delays in Los Angeles and Tokyo, and missed connection of flights in Bangkok, I arrived Delhi one day late. The planned visit to the Central Potato Research Institute at Simla was, as a result, regrettably cancelled.

Between 20 and 25 October, I had the opportunity and pleasure of observing the research and interacting with the plant pathologists, other agricultural scientists, and administrators in Delhi, Cochin, Calicut, Peruvannamuzhi, Kasaragod and Vittal, on Phytophthora diseases of various plantation crops. On 26 - 30 October, at the Goa Workshop, I followed the paper presentations, participated in the discussions, and exchanged information

with the plant pathologists from Indonesia, Malaysia, as well as from India, many of whom have been my co-authors of publications on black pepper in the past six years. On the following pages are some of the important observations and suggestions I wish to make as related to the current status of research on the biology, pathology, and control of the Phytophthora fungi causing diseases on these plantation crops.

CHRONOLOGY OF EVENTS AND ACTIVITIES

- 16 Oct 88 (Sun) Departure Riverside 8:30 A.M. for Los Angeles. Flight from Los Angeles scheduled for 12:30 P.M. departure was delayed for 21 hours. Overnight Los Angeles.
- 17 Oct 88 (Mon) Departure Los Angeles 9:30 A.M. Arrival Tokyo 12:30 P.M. on 18 Oct.
- 18 Oct 88 (Tue) Departure Tokyo 7:30 P.M. (one hour delay). Arrival Bangkok 11:20 P.M.; missed connection to the flight to Delhi. Overnight Bangkok.

- 19 Oct 88 (Wed) Departure Bangkok 11:45 PM.
- 20 Oct 88 (Thu) Arrival Delhi 2:10 AM. Studied report on "late blight in India" of the Central Potato Research Institute. Discussion with Dr. D.N. Srivastava in the afternoon and evening.
- 21 Oct 88 (Fri) Visited Winrock International, USAID, and ICAR. Met more ICAR scientists at the evening dinner.
- 22 Oct 88 (Sat) Departure Delhi by air 5:40 AM. Arrival Cochin 10:30 AM. Visited Biotechnology lab of A.V. Thomas & Co. Arrival Calicut by car 8:30 PM.
- 23 Oct 88 (Sun) All-day visit to Peruvannamuzhi Experimental Farm on black pepper experiments. Return to Calicut in the evening.
- 24 Oct 88 (Mon) Discussed Phytophthora diseases of cardamom with the pathologists from Myladumpara Research Station and black pepper diseases with the Calicut scientists. Visited pathology laboratories and screen houses and discussed Phytophthora. Departure Calicut by train 4:00 PM. Arrival Kasaragod 8:00 PM.
- 25 Oct 88 (Tue) All day visit to Central Arecanut Research Station in Vittal, Karnataka. Discussed Phytophthora diseases of

cocoa and arecanut. Also discussed Thielaviopsis
paradoxa on coconut later in Kasaragod. Departure
Kasaragod by train 7:10 PM. Arrival Cochin 4:00 AM on
26 October.

- 26 Oct 88 (Wed) Discussed Phytophthora diseases of cardamon with three
pathologists in a Cochin hotel. Departure Cochin by
air 1:40 PM. Arrival hotel in Goa 4:30 PM. Prepared
next day's lecture.
- 27 Oct 88 (Thu) Participated in the International Workshop on Wilt
Diseases of Black Pepper, in Panaji, Goa. Presented
special lecture 6:10 PM.
- 28 Oct 88 (Fri) Second day of the Workshop.
- 29 Oct 88 (Sat) Third day of the Workshop. Field trip in Goa including
visits to pesticide and fertilizer factories.
- 30 Oct 88 (Sun) Report preparation. Departure Goa by air 3:15 PM.
Arrival Delhi 5:30 PM
- 31 Oct 88 (Mon) Report preparation.
- 1 Nov 88 (Tue) Debriefing and finalizing report.
- 2 Nov 88 (Wed) Departure Delhi by air 12:50 AM, to return to Riverside
via Bangkok, Tokyo, and Los Angeles.
- 3 Nov 88 (Thu) Scheduled to arrive Los Angeles at 9:00 AM, Riverside
at noon.

OBSERVATIONS, COMMENTS, AND SUGGESTIONS

The experimental work on plant diseases underway at the National Research Center for Spices at Calicut and at the Peruvannamuzhi Experimental Farm appears wide-ranging and of high quality. The scientists discussed their work with pride and enthusiasm, and the cooperation among the pathologists and between the pathologists and nematologists seems good, which in turn has brought fruitful and productive results. The Indian scientists have made great progress in the elucidation of etiology and epidemiology of the so-called quick wilt and slow wilt diseases of black pepper, far more than in other black pepper growing countries. The roles which Phytophthora and the burrowing nematode play in the deterioration of feeder roots and expression of above-ground symptoms of black pepper plants have been amply demonstrated by the pathologists and nematologists in Calicut. The data on the modes of disease development and disease spread of both quick wilt and slow wilt are also quite convincing.

The research on fungicidal control of Phytophthora on black pepper has helped in improving the measures and strategies for satisfactory disease management on black pepper. The efficacies of Bordeaux Mixture (1% spray

and 10% paste) as a protectant are well demonstrated. Their continued use is encouraged. The findings on satisfactory reduction of foot rot incidence by soil drench with 100 ppm metalaxyl should lead to further experimentation of this systemic fungicide in an integrated disease management program. The lack of excellent disease control by 2000 ppm of fosetyl-Al should not be considered as a failure of this chemical to reduce *Phytophthora* root infection on black pepper. More than one concentration of each of these two fungicides should be tested and compared as soil drenches. It is highly probable that fosetyl-Al at 3000 ppm or higher (concentrations found to be highly effective in controlling *Phytophthora* fungi in other crop plants) may equal or be superior to metalaxyl. Fosetyl-Al is a systemic chemical possessing a unique property of downward translocation in many plants. I suggest that this fungicide be tested as a foliar spray as well as stem injection, in addition to the use as a soil drench.

The program on the selection, breeding, and screening for resistant or tolerant cultivars in black pepper to *Phytophthora* has not yet produced outstanding results to date, but should be continued with vigilance.

Horizontal resistance, or field resistance, is the more preferred type and it is hoped that with continued effort a desirable cultivar will soon be

found. Expansion and improvement of facilities at Calicut for resistance screening are recommended here. It would be highly desirable to conduct these experiments under controlled temperature and humidity. The current practice in Calicut of using 100,000 zoospores per plant in screening tests seems too severe a treatment to allow any probable tolerant cultivars or individuals to escape severe damage or death. The use of a moderate level of inoculum (e.g. 100 - 300 non-zoospore propagules per gram of natural soil) could be initially tested and later modified. The concept of testing resistance to Phytophthora in a natural "pest hole" could also be considered.

Continued studies on the use of cultural and biological control methods are to be encouraged. Neem cake, oilseed meals, animal manures, and other nitrogenous organic fertilizers should be tested in an expanded fashion as potential soil amendments for Phytophthora suppression as well as nematode control.

I observed quantitative work on inoculum density and disease potential of Phytophthora at Calicut with admiration. It is tedious work for the pathologists there, but the results seemed outstanding. The use of Albizzia

faliata leaf pieces as bait for isolating and quantifying Phytophthora in black pepper soils can be considered as a boon to simplifying the isolation procedure. One suggestion can however be made to further improve the current Calicut practice of using Petri dishes in running the serial dilution endpoint method to obtain the disease potential indices. If a larger container and higher volume of water are used, a greater water/soil ratio can be achieved which should improve Phytophthora recovery from soils with low levels of disease potentials.

The use of the non-specific descriptive names of quick wilt and slow wilt of black pepper may hopefully be discontinued soon. Neither wilt is a true wilt, i.e. a vascular wilt. The traditional and long-held name of Phytophthora foot rot should replace quick wilt which is not used anywhere outside India. The name slow wilt, which has etiological agents of nematodes, Phytophthora, or other fungi causing damages on feeder roots, should also be replaced by a more suitable name. Such a change in names was discussed at the Goa Workshop by delegates from India, Indonesia, and

Malaysia. It would be desirable if such name changes are accepted by pathologists of all black pepper growing nations.

That 'Phytophthora palmivora' MF4 (morphological form 4) is the prevalent species occurring on black pepper throughout the world has been generally accepted by most pathologists for several years now. However, some pathologists in India and black pepper agronomists alike have been too casual in its use and still call it P.palmivora without the quotation marks or without adding the suffix MF4. It is strongly urged that no such omissions be made in the future in order not to further mislead the lay people that the black pepper isolates are the same as the common P.palmivora occurring on many other plantation crops in the tropics. Since the species P.capsici has been accurately redescribed to include the correct and newly recognized features, and since 'P.palmivora' MF4 has been merged with P.capsici, the use of 'P.palmivora' MF4 should be henceforth discontinued. However, for the sake of continuity in the literature, it is suggested that for an extended period of time both names be used in conjunction -- in the form of P.capsici (= 'P.palmivora' MF4).

Unlike in the case of black pepper Phytophthora isolates in India which, to a great extent, have been identified accurately, Phytophthora isolates from arecanut, cardamon, betelvine, and some others have not been correctly identified to the species level. While the cocoa isolate I examined in Vittal was correctly called P.palmivora, the arecanut isolate shown to me as P.arecae at Vittal had non-caducous sporangia and did not resemble either P.arecae or P.palmivora, both of which are known to occur on arecanut in the literature. The cardamon isolate is purportedly P.nicotianae or P.meadii, but the descriptions given to me by the pathologists of the Indian Cardamon Research Station did not appear to me as being either of the two species. The betelvine isolates have been called P.parasitica var piperina by some Indian pathologists, but most betelvine isolates I have examined in the past resembled closely the black pepper isolates and therefore belonged to 'P.palmivora' MF4. As light greatly influences sporangium morphology, I strongly urge that all sporangium cultures be incubated under continuous light for correct identification to Phytophthora species. I am also willing to receive (with proper import permit labels) any Phytophthora isolates for identification in my Riverside laboratory.

Finally, for correct diagnosis and detection of Phytophthora diseases in India, I have another recommendation to offer. In most plantation crops in the tropics, certainly in many spice crops, there are known Phytophthora species causing infection on roots, crown, as well as various aerial plant parts. It is widely known that Phytophthora infections are extremely difficult to detect and isolate especially by researchers who are inexperienced in handling Phytophthora and are unaware or unfamiliar with any of the many special techniques necessary for the successful detection, isolation, and identification of Phytophthora fungi. Possibly because of that, Phytophthora infections on oil palm, ginger, cinnamon, nutmeg, vanilla, and other plantation or spice crops, which have been reported elsewhere in the world, have not yet been observed or known in India. These diseases might not occur in India, but it is also likely that they do occur but have not yet been found by Indian pathologists. I suggest that pathologists with different crop responsibilities be coordinated and be made possible to work with and be trained by pathologists in another institute or with other crop responsibility who have already gained experience in detection, isolation, and identification of Phytophthora spp. The special techniques are relatively easy to learn within a short period. Adequate training of such special procedures for Phytophthora research will assure correct diagnoses of many important Phytophthora diseases on plantation crops in India.

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