PN-ABN-474

MANAGEMENT REPORT

Covering Period: 8/31/92 to 2/28/93

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Identification of resistance in banana to races of the fusarial wilt fungus

Principal Investigator: Randy C. Ploetz
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Grantee Institution: University of Florida

Collaborator: José Galindo
Institution: CATIE

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A.I.D. Grant Project Officer: Benjamin Waite

Project Duration: 8/31/90 to 10/30/93

1) Scientific Summary: Significant additions from Southeast Asia, Brazil, and East Africa have been made to the Homestead collection of *Fusarium oxysporum* f. sp. *cubense*. All of these are important banana-growing regions which were poorly represented in the collection.

Work on electrophoretic karyotypes (EKs) of *F. oxysporum* f. sp. *cubense* has been completed and a manuscript detailing the results is in preparation (post-doctoral associate Boehm, Gainesville). In summary, strains of the fungus within the taxon, as a whole, had quite variable EKs, whereas those within VCGs of the taxon had relatively uniform EKs; those from VCGs from small geographic regions had almost identical EKs (please refer to Figure 1 and Table 1 in appendices). Telomeric sequence probes were used to demonstrate that high molecular weight DNAs resolved during the work were, in fact, chromosomes. No prior study had ever unequivocally demonstrated the chromosomal nature of these DNAs. Chromosomes were successfully probed with ribosomal DNA sequences. However, cDNA work with probes from small chromosomes in different strains and VCGs of *Fusarium oxysporum* f. sp. *cubense* was not successful. At this time, it is not known whether the small chromosomes are dispensable (i.e., whether they could be considered B chromosomes), or if those from a given strain are homologous with others in the same VCG or with those from other VCGs of the pathogen. B chromosomes have been shown to contain genes for pathogenicity in other plant pathogens.

RFLP-cDNA work with genomic DNA from strains of *Fusarium oxysporum* f. sp. *cubense* and single copy probes from *Fusarium oxysporum* radicis *lycopersici*, the tomato crown rot pathogen, is proceeding in Gainesville (graduate student Koenig). The probes were informative when used in previous phylogenetic work in Israel (Elias et al., Volcani Center). The objectives of this present work are two-fold: 1) to establish genetic relationships within and among VCGs of *F. oxysporum* f. sp. *cubense*, and 2) to identify race- and VCG-specific DNAs that could be used for RAPD-assisted identification of infected banana plants and infested soils.

Work to utilize peroxidase production in the banana host as a means by which clones with resistance to fusarium wilt could be identified has been discontinued. Although work from other laboratories suggested that this might be a fruitful approach, work at TREC, Homestead indicated that: 1) the number and type of peroxidase isozymes in various tissues and clones of banana that could be resolved by isoelectric focussing was quite variable, even under standardized, tissue-culture situations; and 2) peroxidase polymorphisms could not be related to resistance in banana to fusarium wilt.

Studies during which tissue-culture-derived banana plantlets were screened for resistance in growth chambers were halted by hurricane Andrew (August 24, 1992; see Managerial Issues).

2) Scientific Issues: None to report for this period.

3) Managerial Issues: TREC suffered severe damage and has yet to resume full operations after hurricane Andrew. Since electrical power was only restored to TREC ca. 3 months after the hurricane, banana plantlets produced via tissue-culture, and screening experiments that used these plantlets and which were in progress at the time of the storm, were both lost. Although electrical power is now restored at TREC, the senior researcher on the project (Ploetz) still experiences personnel problems as a result of the storm. Ploetz has lost the services of his state line-item technician, Jorge Parrado, for health reasons, and the technician hired for the project, Jack Kramer, left Homestead for another job. The project technician position is currently advertised. Until a replacement for this position can be identified, the screening aspect of the project is on hold.

4) Special Concerns: Special concerns that have arisen on the project are outlined above in Managerial Issues.

5) Collaboration, Travel, Training and Publications: R.C. Ploetz was invited to three scientific meetings during the period. He reported on, among other issues, progress made on this research project. Papers that were presented at the meetings and which will appear in proceedings for the meetings are listed below (publications 2 - 4), as is an additional publication which was produced with support from the project (publication 1).

In August, Ploetz surveyed highland areas in Uganda and Burundi for INIBAP to assess the incidence and severity of fusarium wilt on the East African highland AAA cultivars (important food sources in the region). A technical report is in preparation. In addition, Ploetz was invited by INIBAP to attend a research planning meeting to establish protocols for screening different banana genotypes for resistance to fusarium wilt. The meeting was held in Taiwan and preceded the meeting at which publications 3 and 4 were presented.

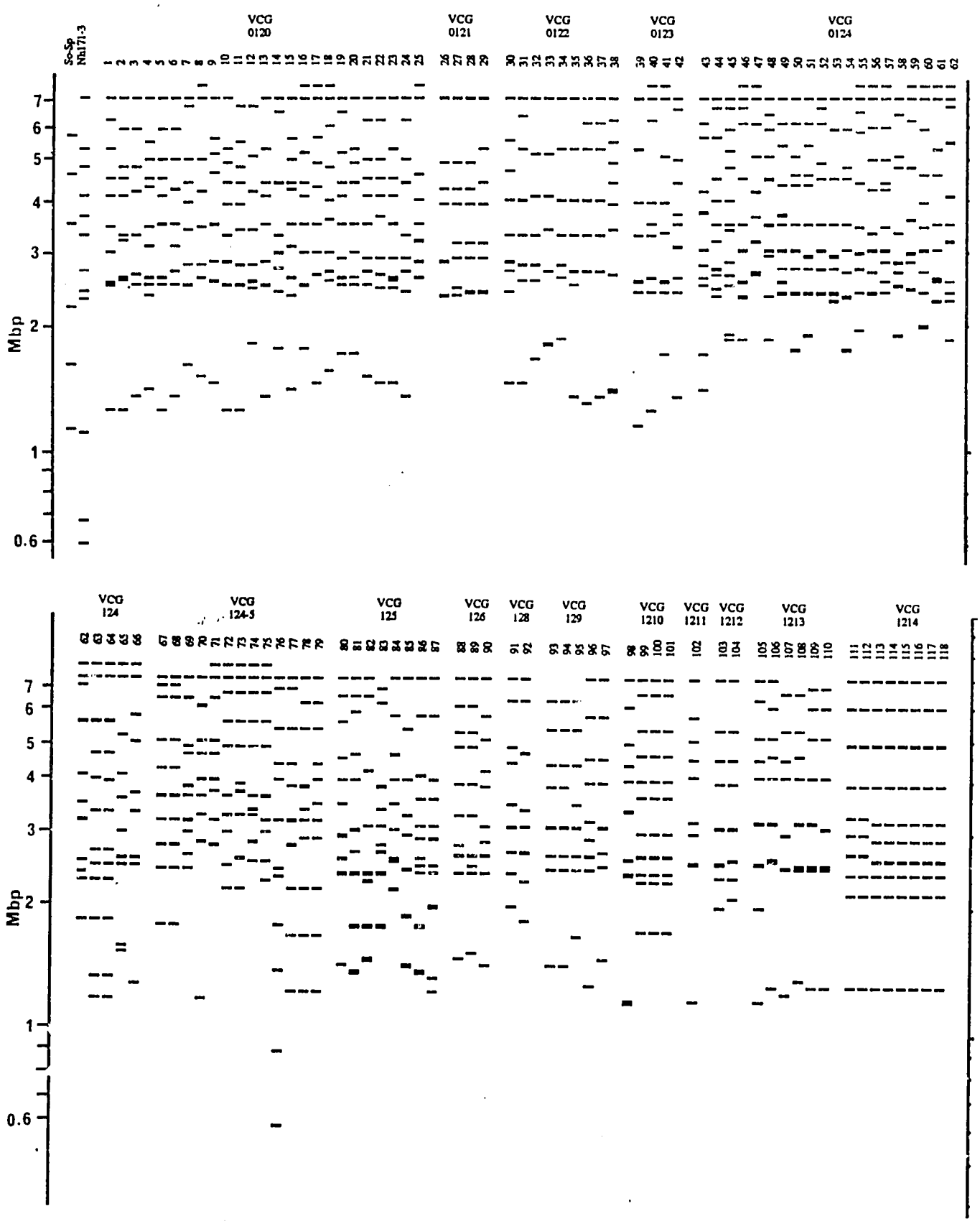
Project publications since the last report:

1. Kistler, H.C., and Miao, V. 1992. New modes of genetic change in filamentous fungi. Annu. Rev. Phytopathol. 30:(In press).
2. Ploetz, R.C. 1992. Fusarium wilt (Panama disease). Proc. International Symposium on Genetic Improvement of Bananas for Resistance to Diseases and Pests. CIRAD. Montpellier, FRANCE. 7-9 September, 1992.
3. Ploetz, R.C. 1992. A brief introduction to variability in *Fusarium oxysporum* f. sp. *cubense*. Proc. International Symposium on Recent Development in Banana Cultivation Technology. Taiwan Banana Research Institute. Pingtung, TAIWAN. 14-16 December, 1992.
4. Ploetz, R.C. 1992. Variation in *Fusarium oxysporum* f. sp. *cubense* in the Americas and Africa. Proc. International Symposium on Recent Development in Banana Cultivation Technology. Taiwan Banana Research Institute. Pingtung, TAIWAN. 14-16 December, 1992.

6) Request for A.I.D. or BOSTID Actions: No A.I.D. or BOSTID actions are required at this time.

Figure caption.

Figure 1. Schematic diagram of electrophoretic karyotypes of *Fusarium oxysporum* f. sp. *cubense* obtained by pulse field gel electrophoresis. One hundred and eighteen strains in 13 different VCGs are represented in lanes on the x-axes, and the scale on y-axes represents chromosome size in $\log_{10}$ mega basepairs (Mbp); each band within a lane represents a chromosome. Note: 1) the general uniformity within, as opposed to among, strains from different VCGs, 2) the high uniformity among strains from VCGs from small geographic regions (e.g. VCG 01214, Misuku Hills, Malawi), and 3) the presence of very small chromosomes in strains from many of the VCGs (i.e. < 10,000 basepairs).


VCG 0120
VCG 0121
VCG 0122
VCG 0123
VCG 0124
VCG 124
VCG 124-5
VCG 125
VCG 126
VCG 128
VCG 129
VCG 1210
VCG 1211
VCG 1212
VCG 1213
VCG 1214
Mbp
7
6
5
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2
1
0.6

Figure 1.

Table 1. Fusarium oxysporum f.sp. cubense isolates used in this study.

	Isolate[1]	Race[2]	Cultivar[3]	Origin/Collector[4]
VCG[5] 0120: (64%)[6]				
1)	A2.132*	4	Mons mariAAA	Australia
2)	1220.117	?	MonsAAA	Queensland, Australia
3)	1222.130*	4?	Mons	Queensland, Australia
4)	22424.128	?	Lady fingerAAB	Moorina, Queensland, Australia
5)	22425.113	4?	CavendishAAA	Wamuran, Queensland, Australia
6)	22411.129	4?	Cavendish	Wamuran, Queensland, Australia
7)	Pacovan.147	?	PacovanAAB	Bahia, Brazil
8)	Prata.126	?	PrataAAB	Bahia, Brazil
9)	C1.127	4?	Cavendish	Canary Islands
10)	ADJ1.133	4	Dw. CavendishAAA	Adeje, Canary Islands
11)	ADJ2.124	4	Dw. Cavendish	Adeje, Canary Islands
12)	BUE1.140	4	Dw. Cavendish	Buenavista, Canary Islands
13)	GAL1.139	4	Dw. Cavendish	Las Galletas, Canary Islands
14)	GAL2.120	4	Dw. Cavendish	Las Galletas, Canary Islands
15)	IC1.128	4	Dw. Cavendish	Icod de los Vinos, Canary Islands
16)	ORT1.137	4	Dw. Cavendish	La Orotava, Canary Islands
17)	ORT2.115	4	Dw. Cavendish	La Orotava, Canary Islands
18)	PAJ1.136	4	Dw. Cavendish	Pajalillos, Canary Islands
19)	FCJ7.146	?	Lacatan	Jamaica
20)	STGM1.135*	1	Gros MichelAAA'	Costa Rica
21)	3S1.114*	1	HighgateAAA'	Honduras
22)	STH1.148	1	Highgate	Honduras
23)	15638.145	?	?	Malaysia
24)	F9127.144*	4	Grand NaineAAA	South Africa
25)	NH.142	4?	WilliamsAAA	South Africa
VCG 0121: (80%)				
26)	F9130.150	4	Cavendish	Taiwan
27)	GM.149	4?	Gros Michel	Taiwan
28)	ML.164*	4	Cavendish	Taiwan
29)	H1.163	4	Cavendish	Taiwan
VCG 0122: (75%)				
30)	Ph2.01	4?	Cavendish	Philippines
31)	P18.04	4	Cavendish	Philippines
32)	P79.05	4	Cavendish	Philippines
33)	SABA.07	2	SabaABB	Philippines
34)	PW3.08	4?	Cavendish	Philippines

35)	PW4.09	4?	Cavendish	Philippines
36)	PW6.11	4?	Cavendish	Philippines
37)	PW7.12	4?	Cavendish	Philippines
38)	PW5.10	4?	Cavendish	Philippines

VCG 0123: (100%)

39)	DAVAO.151	1?	SilkAAB	Philippines
40)	Ph12.161	?	LatundanAAB	Philippines
41)	PhL2.160	?	Latundan	Philippines
42)	T1.157	1	Gros Michel	Taiwan

VCG 0124: (43%)

43)	GMB.16	?	Gros Michel	Bahia, Brazil
44)	MACA.17	?	Maca (Silk)AAB	Bahia, Brazil
45)	STD2.20	1	Highgate	Honduras
46)	BLUG.21	2	BluggoeABB	Honduras
47)	STJ1.27	?	Grande Naine	Jamaica
48)	MW43.30	?	HarareABB	Chitipa, Karonga, Malawi
49)	MW45.31	?	Harare	Chitipa, Karonga, Malawi
50)	MW47.32	?	Harare	Chesenga, Malawi
51)	MW50.34	?	Harare	Chitipa, Karonga, Malawi
52)	MW52.35	?	Sukali(Silk)AAB	Karonga South, Malawi
53)	MW54.36	?	Harare	Karonga South, Malawi
54)	MW55.37	?	Harare	Karonga, Malawi
55)	MW58.38	?	Harare	Karonga, Malawi
56)	MW64.39	?	Harare	Kaporo North, Malawi
57)	MW65.40	?	Harare	Hara Plain, Karonga, Malawi
58)	MW69.42	?	KholobowaABB	Thyolo, Blantyre, Malawi
59)	MW71.43	?	Kholobowa	Mulanje, Blantyre, Malawi
60)	STN1.47	?	Bluggoe	Corinto, Nicaragua
61)	STPA2.55	?	Pisang AwakABB	Tanzania
62)	B2-1.57	2	Burro(Bluggoe)ABB	Florida
63)	JLTH3.199	?	Klue namwaABB	Smoeng Hwy 1269, Thailand
64)	JLTH7.203	?	Klue namwa	Smoeng Hwy 1269, Thailand
65)	JLTH4.200	?	Klue namwa	Smoeng Hwy 1269, Thailand
66)	JLTH5.201	?	Klue namwa	Smoeng Hwy 1269, Thailand

VCG 0124-5: (62%)

67)	MW5.62	?	Zambia(Bluggoe)ABB	Kaporo, Malawi
68)	MW11.64	?	Harare	Kaporo, Malawi
69)	MW39.66	?	Harare	Chitipa, Karonga, Malawi
70)	MW53.67	?	Sukali	Karonga, Malawi
71)	MW56.68	?	Zambia	Karonga, Malawi
72)	MW61.71	?	Harare	Vinthukutu, Karonga, Malawi
73)	MW66.73	?	Kholobowa	Thyolo, Blantyre, Malawi
74)	MW70.75	?	Kholobowa	Thyolo, Blantyre, Malawi

75)	MW86.76	?	Mbufu(Bluggoe)ABB	Chitipa, Karonga, Malawi
76)	JLTH1.197	?	Klue namwa	Smoeng Hwy 1269, Thailand
77)	JLTH16.212	?	Klue namwa	Ban Nok, Thailand
78)	JLTH17.213	?	Klue namwa	Ban Nok, Thailand
79)	JLTH18.214	?	Klue namwa	Ban Nok, Thailand
VCG 0125: (42%)				
80)	A1.78	1	Lady finger	Australia
81)	8611.82	1	Lady finger	Currumbin, Queensland, Australia
82)	22479.86	1	DucasseABB	Bowen, Queensland, Australia
83)	1S.92	?	WilliamsAAA	Bodles, Jamaica
84)	STPA3.93	?	Pisang Awak	Uganda
85)	STNP5.94	?	Ney PoovanAB	Zaire
86)	JLTH20.216	?	Klue namwa	Ban Nok, Thailand
87)	JLTH21.217	?	Klue namwa	Ban Nok, Thailand
VCG 0126: (30%)				
88)	STM3.165*	1	ManquenoAAB	Honduras
89)	STA2.158	1	Highgate	Honduras
90)	STB2.172	1	Highgate	Honduras
VCG 0128: (66%)				
91)	22994.96	?	Bluggoe	South Johnstone, Queensland, Australia
92)	A47.97	?	Bluggoe	Comores Islands
VCG 0129: (55%)				
93)	N5443.169	4?	Cavendish	Doonan, Queensland, Australia
94)	8627.170	4?	Cavendish	North Arm, Queensland, Australia
95)	22402.171	4?	Cavendish	Wamuran, Queensland, Australia
96)	1221.166	1	Mons	Queensland, Australia
97)	22507.167	?	Lady Finger	Queensland, Australia
VCG 1210: (20%)				
98)	GG1.174	1	Apple(Silk)AAB	Florida
99)	JC1.189	1	Apple	Florida
100)	JC4.186	1?	Apple	Florida
101)	JC7.181	1?	Apple	Florida
VCG 1211: (50%)				
102)	SH3142.190	?	SH 3142AA	Queensland, Australia
VCG 1212: (50%)				
103)	STNP1.98	?	Ney Poovan	Pemba Island, Zanzibar, Tanzania
104)	STNP3.100	?	Ney Poovan	Pemba Island, Zanzibar, Tanzania

VCG 1213: (75%)

105)	1-2.119	4	Cavendish	Taiwan
106)	2-2.195	4	Cavendish	Taiwan
107)	4-1-1.194	4	Cavendish	Taiwan
108)	4-2-1.193	4	Cavendish	Taiwan
109)	5-1-1.192	4	Cavendish	Taiwan
110)	6-2.191	4	Cavendish	Taiwan

VCG 1214: (80%)

111)	MW2.102	?	Harare	Misuku Hills, Karonga, Malawi
112)	MW7.103	?	Harare	Misuku Hills, Karonga, Malawi
113)	MW40.104	?	Harare	Misuku Hills, Karonga, Malawi
114)	MW41.105	?	Mbufu	Misuku Hills, Karonga, Malawi
115)	MW44.107	?	Harare	Misuku Hills, Karonga, Malawi
116)	MW46.108	?	Harare	Misuku Hills, Karonga, Malawi
117)	MW48.109	?	Harare	Misuku Hills, Karonga, Malawi
118)	MW51.110	?	Harare	Misuku Hills, Karonga, Malawi

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