Vegetables / Legumes

CROP: Crucifers

LOCATION: Nova Scotia

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TITLE: RACE SURVEY OF *PLASMODIOPHORA BRASSICAE* IN NOVA SCOTIA

METHODS: Samples of plants showing severe symptoms of clubroot were obtained from 10 fields of various cruciferous crops (Bok Choi, broccoli, cabbage, cauliflower and rutabaga) throughout Nova Scotia in 1993. The clubbed roots were washed and stored frozen at -20 C. Resting spores were obtained by grinding 100 g of frozen clubbed tissue in 400 mL water for 3 min in a blender (3). The macerate was filtered through cheesecloth and the filtrate centrifuged at 2,000 g for 7 min. The supernatant was discarded and the pellet containing spores was resuspended in water and recentrifuged. The final spore concentration was then adjusted to 5×10^7 spores/mL. Race designations of the various isolates were determined on two differential cultivars of cabbage (*Brassica oleracea* L. var. *capitata* L., Jersey Queen and Badger Shipper) and two cultivars of rutabaga (B. *napobrassica* Mill., Laurentian and Wilhelmsburger). Roots of 10-day old seedlings were washed, dipped into the appropriate spore suspension and then transplanted into a soil mix containing peat moss, loam soil, and sand (2:1:1, v/v) at pH 5.5. There were four seedlings/pot and four replicate pots/cultivar for each P. *brassicae* isolate. The plants were allowed to grow for six weeks on a greenhouse bench. Soil was then washed from the roots and the roots were rated for disease severity according to the scheme of Seaman et al. (2) and race designations followed those of Williams (3).

RESULTS AND COMMENTS: Of the 10 isolates, eight were designated as race 3, one was race 2 and one was race 1. Although the sample size was small, it appears that the race structure may have shifted to a predominance of race 3 in comparison to a survey reported by Ayers in 1972 (1) in which races 2 and 3 were present in similar proportions. Of concern is the fact that a field of rutabaga, cultivar York, was severely affected by race 3. This may confirm suspicions that resistance in York is beginning to breakdown.

REFERENCES:
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2. Seaman, W.L., Walker, J.C. and Larson, R.H. 1963. A New race of *Plasmodiophora* brassicae affecting Badger Shipper cabbage. Phytopathology 53:1426—1429.
3. Williams, P.H. 1966. A System for the determination of races of *Plasmodiophora* brassicae that infect cabbage and rutabaga. Phytopathology 56:624—626.

CROP: Potato (*Solanum tuberosum* L.)

LOCATION: Alberta, southern, central and north-central

NAME AND AGENCY:

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TITLE: LATE BLIGHT OF POTATO IN ALBERTA - 1994

METHODS: The survey was conducted in forty-two commercial potato fields (1489 hectares) in southern Alberta (11 - 14 August), six fields (172 hectares) in central Alberta (14 - 18 August) and thirty-six potato fields (654 hectares) in north-central Alberta (15 August - 2 September). The southern Alberta fields were located in the County of Newell (Co. # 4), the Municipal District of Taber (M.D. # 14) and the County of Lethbridge (Co. # 26), while fields of central Alberta were in the Counties of Ponoka (Co. # 3), Lacombe (Co. # 14), and Red Deer (Co. # 23) and in the Municipal District of Rocky View (M.D. # 44). Fields of north-central Alberta were in the City of Edmonton, the County of Parkland (Co. # 31), the Municipal District of Sturgeon (M.D. # 90) and the Improvement District of Yellowhead (I.D. # 14) (Fig. 1). Late blight incidence and severity were assessed at five randomly selected sites representative of the disease in the field. At each site, the incidence of the disease was assessed by counting the number of infected plants out of 10 along a row. The disease severity was estimated on the same plants using the 0 to 100% leaf area infection scale, as suggested by James (1971). From sites with severity levels $\geq$ 5%, fifteen to twenty tubers were dug, cut with a sharp knife and examined for symptoms of late blight tuber rot. Blight-infected leaf samples were also collected from each site and sent to Drs. H.W. Platt (Agriculture and Agri-Food Canada, Prince Edward Island) and Z.K. Punja (Simon Fraser University, British Columbia) for assessment of the metalaxyl sensitivity of the pathogen isolates and also to test for the possible occurrence of the *A2* mating type in Alberta. The samples are being processed. Occurrence of other diseases and disorders was also recorded.

RESULTS AND COMMENTS: Late blight was not observed in any field in southern Alberta, and in just one field in central Alberta. In the north-central region, 100% of the fields visited had late blight (Table 1, Fig. 1). The incidence of the disease varied from a trace to 100%, while the severity ranged from a trace to >75% (Tables 1 and 2). The incidence of infected tubers, which were found in 32% of the north central Alberta fields, ranged from 0 to 40% at the time of survey. According to some growers, the percentage of infected tubers reached much higher levels at harvest. The occurrence of the late blight in Alberta appears to be correlated to precipitation (Fig. 2). There was extensive rainfall in the north-central region, but very little in the south.

The cultivars Banana, Ranger Russet and Yukon Gold showed high levels of late blight (Table 3). Cultivars showing low levels of disease may not necessarily have been resistant, but may have escaped infection. Atlantic had no disease in two separate fields where other cultivars showed high disease incidence (Table 4), suggesting that Atalantic may possess resistance to the disease.

The occurrence of late blight was negatively correlated with the application of fungicides (Table 5). Application of contact fungicides alone or in combination with a systemic fungicide, Ridomil-MZ, significantly reduced disease incidence and severity. In north-central Alberta, the contact fungicide Bravo 500 was most used; Ridomil-MZ was used in only two fields. Use of fungicides (contact as well as systemic) was quite common in southern Alberta. Extensive application of Bravo/Dithane DG and Ridomil by farmers, along with unfavourable weather conditions for late blight development may have prevented the occurrence of the disease in the south.

Other diseases and disorders recorded during the survey were: bacterial soft rot (*Erwinia carotowora* subsp. *carotowora*), blackleg (*Erwinia carotowora* subsp. *atroseptica*), early blight (*Alternaria solani*), purple top (aster yellows phytoplasma), scab (*Streptomyces scabies*), silver scurf (*Helminthosporium solani*), wilts (*Fusarium* spp. and *Verticillium* spp.), and herbicide damage.

An epidemic of late blight was reported in southern Alberta in 1992, but the disease was not recorded in central or north-central Alberta (Howard et al., 1993). Reports of some tubers obtained from storages in north-central Alberta showing late blight infection in the spring of 1994 suggest that late blight must have occurred in some fields in 1993, even though the incidence must have been low. Late blight occurred at epidemic levels in 1994 in north-central Alberta. This is the first record of the occurrence of a late blight epidemic in north-central Alberta. The presence of the primary inoculum in the region and favourable weather conditions contributed towards the development of a epidemic of the disease.

REFERENCES:

1. **Howard, R.J. et al. 1993. Potato late blight survey in southern Alberta — 1992. Canadian Plant Disease Survey** 73:106—108.
2. **James, C. 1971. A Manual of assessment keys for plant diseases. Canada Dept. of Agriculture, Publ. No.** 1458.

TABLE 1. Occurence **of late blight (LB)** on **potato** in **Alberta, 1994**

Region/District*	Surveyed for LB			% Fields with LB	
	No.of fields	Area (hectares)	% area with LB	Foliar blight	Tuber rot
Southern Alberta					
Co. Newell (#4)	15	361.1	0	0	0
M.D. of Taber (#14)	17	701.6	0	0	0
Co. of Lethbridge (#26)	9	352.2	0	0	0
Central Alberta					
Co. of Ponoka (#3)	2	32.4	0	0	0
Co. of Lacombe (#14)	2	16.2	0	0	0
Co. of Red Deer ((#23)	1	1.3	100	100	0
M.D. of Rocky View (#44)	1	121.5	0	0	0
North-central Alberta					
City of Edmonton	9	110.9	100	100	22
Co. of Parkland (#31)	13	306.1	100	100	15
M.D. of Sturgeon (#90)	5	183.4	100	100	40
I.D. of Yellowhead (#14)	10	55.5	100	100	50

* Co. = County, M.D. = Municipal District, I.D. = Improvement District.

TABLE 2. Incidence of late blight on potato foliage and tubers in Alberta, 1994.

Regions / District*	No. of fields	Foliar infection (%)		Tuber infection (%)
		Inc. (range)**	Sev. (range)	Inc. (range)
Southern Alberta				
Co. of Newell (#4)	15	0	0	0
M.D. of Taber (#14)	24	0	0	0
Co. of Lethbridge (#26)	9	0	0	0
Central Alberta				
Co. of Ponoka (#3)	2	0	0	0
Co. of Lacombe (#14)	2	0	0	0
Co. of Red Deer (#23)	1	< 1	< 1	0
M.D. of Rocky View (#44)	1	0	0	0
North-central Alberta				
City of Edmonton	9	16 (2 - 100)	9 (<1 - 75)	5 (0 - 40)
Co. of Parkland (#31)	13	9 (<1 - 75)	6 (<1 - 75)	1 (0 - 10)
M.D. of Sturgeon (#90)	5	17 (1 - 50)	3 (<1 - 10)	3 (0 - 10)
I.D. of Yellowhead (#14)	10	25 (<1 - 100)	16 (<1 - 75)	3 (0 - 10)

*

** Co. = County, M.D. = Municipal District, I.D. = Improvement District.
Inc. = incidence, % of plants with late blight infection. Sev. = severity, % of leaf surface area covered with the lesions.

TABLE 3. Late blight infection on foliage and tubers of various potato cultivars, surveyed in Alberta, 1994.

	North-central Alberta				Central Alberta				Southern Alberta			
Cultivar	Field infd/surv *	Area infd/surv *	Foliar inc (sev) **	Tuber inf (%) ***	Field infd/surv	Area infd/surv	Foliar inc (sev)	Tuber inf (%)	Field infd/surv	Area infd/surv	Foliar inc (sev)	Tuber inf (%)
AU Blue	1 / 1	0.2 10.2	5 (<1)	0		-						
Amisk	1 / 1	28.3 / 28.3	5 (1)	0		-						
Atlantic						-			011	0 / 24.3	0	0
Banana	1 / 1	0.8 / 0.8	100 (75)	40		-						
Bintje	111	8.1 18.1	5 (<1)	0		-						
Chipita						-			0 / 1	0 10.2	0	0
Delta Gold	111	0.4 / 0.4	< 1 (<1)	0		-						
FL 1533						-			012	0 154.7	0	0
FL 1625									*011*	0 126.3	0	0
Frontier Russet	111	2.0 12.0	< 1	< 1								
Hi-Lite Russet	1 / 1	6.1 16.1	< 1 (<1	0								
Niska									013	0 / 57.5	0	0
Norchip	1 / 1	0.04 / 0.04	5 (1)	0					0 / 15	0 1508.5	0	0
Norland	5 / 5	51.4 / 51.4	21 (9)	2	0 / 1	0 140.5	0	0	013	0 / 26.3	0	0
Ranger Russet	313	21.5 121.5	42 (34)	5					*011*	0 / 24.3	0	0
Russet Burbank	11 / 11	215.3 1275.3	11 (8)	0.5	115	1.3 / 115.8	< 1 (<1)	0	0111	0 / 417.0	0	0
Russet	717	246.2 *1* 246.2	13 (2)	2	*011*	018.1	0	0	012	0 / 52.6	0	0
Snowden									014	0 / 139.3	0	0
Sangre	111	10.1 / 10.1	1 (<1)	0	012	0 / 6.9	0	0				
Shepody									*015*	0 / 109.3	0	0
W 7530		-	-			-			*011*	0 10.27	0	0
Yukon Gold	111	0.8 10.8	25 (15)	5	-	-	-	-	-	-	-	-

*

** Number of fields or area infected / number of fields or area surveyed.

*** Foliar inc (sev) = percentage of plants showing late blight infection, and (percentage of leaf area covered with blight); values represent mean of all fields.
Tuber inf = percentage of tubers showing late blight infection.

TABLE 4. Incidence and severity of late blight in four cultivars in two experimental fields in the City of Edmonton and the Municipal District of Sturgeon, 1994.

Cultivar	City of Edmonton	M.D. of Sturgeon
Atlantic	0 *	0
Norchip	100 (1)	100 (3.5)
Russet Burbank	100 (< 1)	100 (1)
Yukon Gold	100 (4)	100 (3)

* Percent of plants with foliar late blight symptoms; values in parenthesis denote the severity of late blight on leaves using the scale of James, C. (1971). All values represent a mean of four replications.

TABLE 5. Effect of fungicides on foliar and tuber late blight in north-central Alberta, 1994.

		Foliar late blight (%)**		
Fungicide application*	No. of fields	Incidence (range)	Severity (range)	% Tubers infected (range)
None	19	25.4 (< 1 - 100)	16.8 (< 1 - 75)	3.9 (0 - 40)
Contact	15	7.8 (<1 - 50)	1.4 (<1 - 10)	1.1 (0 - 10)
Contact and systemic	2	< 1 (<1)	< 1 (< 1)	0

* Contact and systemic fungicides were Bravo and Ridomil-MZ, respectively.

** Foliar late blight incidence = percent of the plants with late blight symptoms, while the severity = percent of the leaf surface area covered with the lesions.

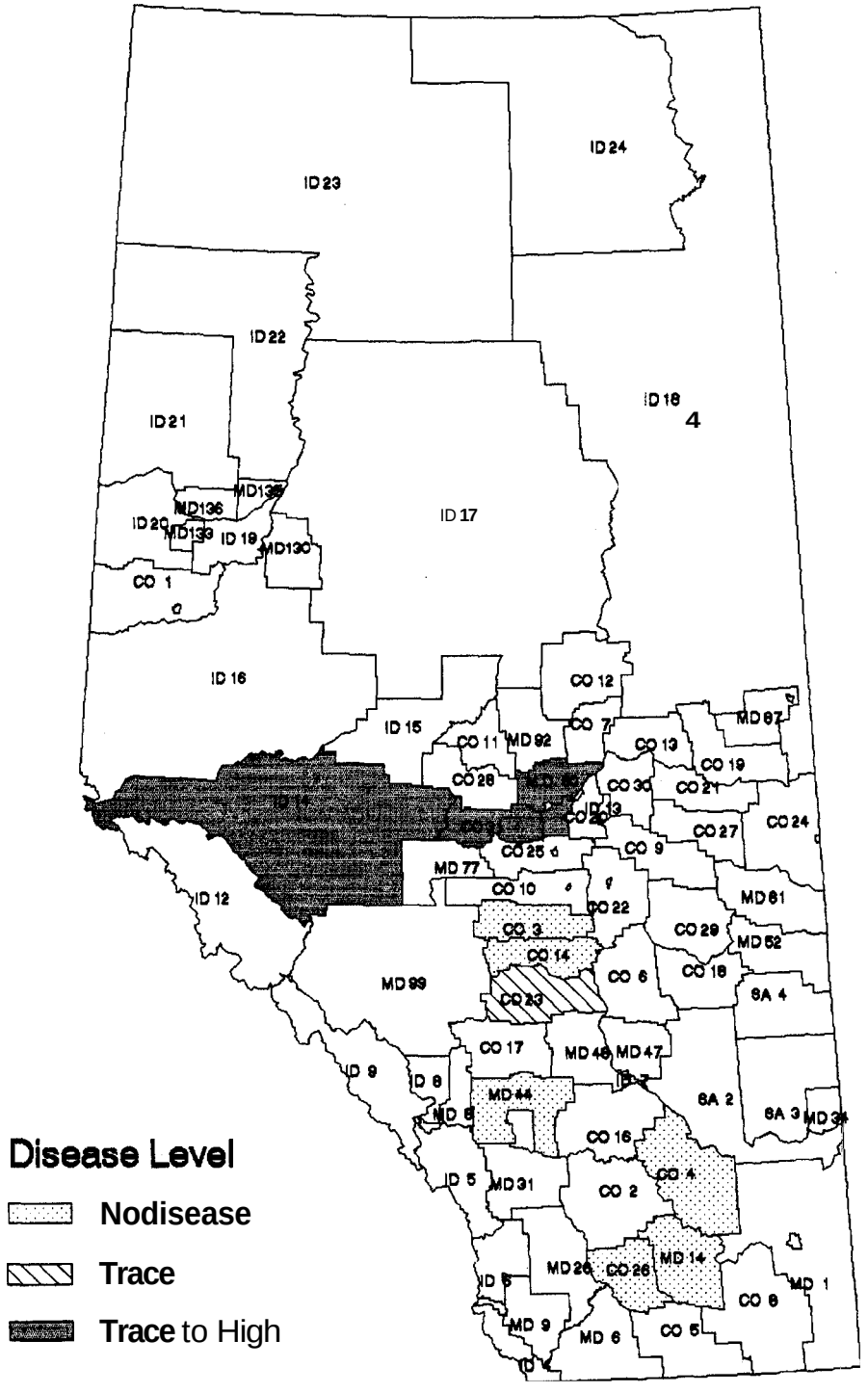

FIG. 1. Incidence of late blight on potato in Alberta, 1994.

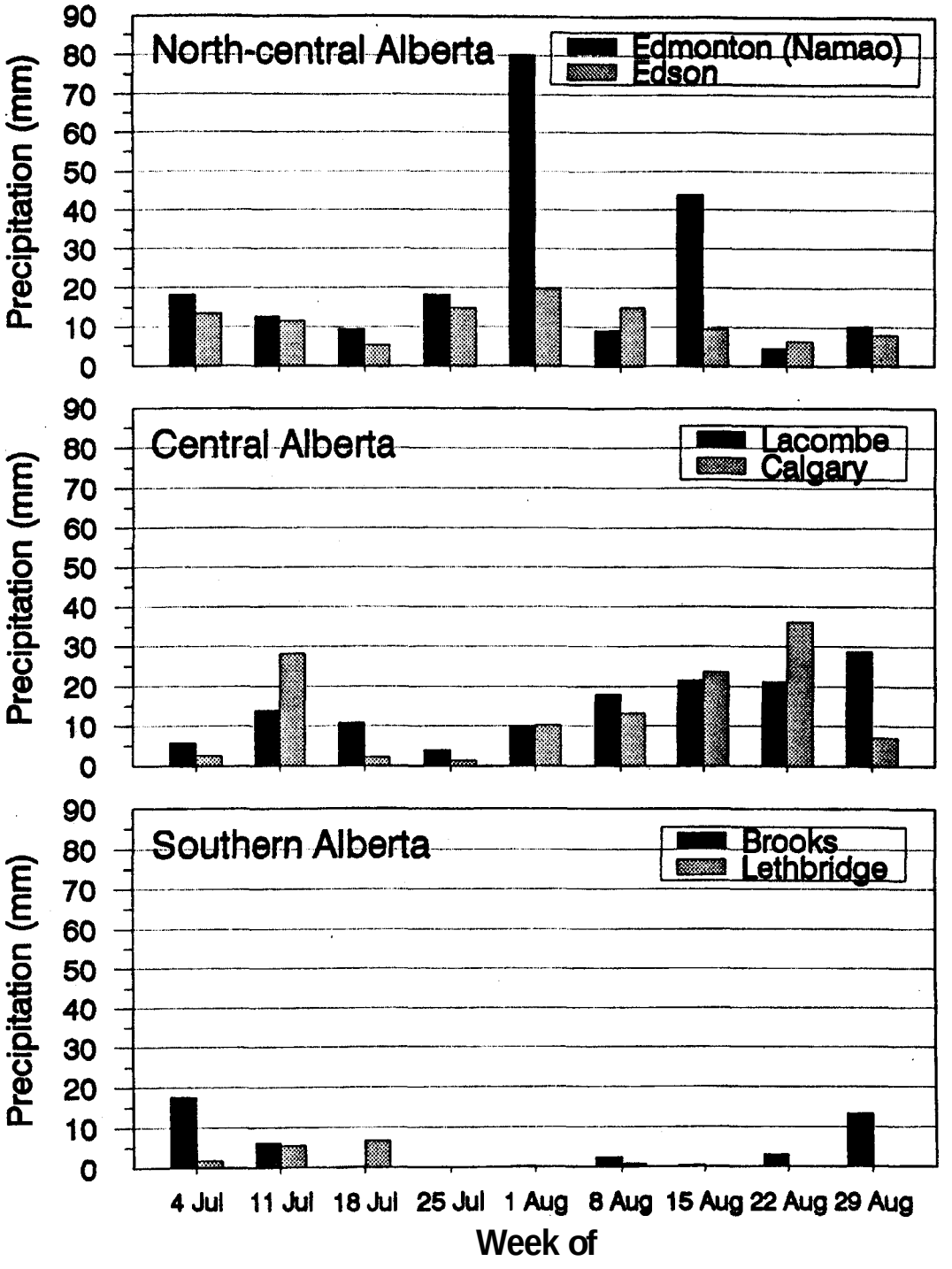

FIG. 2. Precipitation at selected sites in Alberta, 1994.

CROP: Pepper, *Capsicum annuum*
Squash, *Cucurbita pepo*

LOCATION: Ontario

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TITLE: *PHYTOPHTHORA CAPSICI* ISOLATED FROM PEPPER AND SQUASH IN ONTARIO

INTRODUCTION: *Phytophthora capsici* Leonian causes root rot, crown rot and foliar blight of pepper and other vegetables in the United States and tropical countries. Originally, the disease was identified in New Mexico but in recent years severe outbreaks of the disease have occurred in more northern areas such as New Jersey, Colorado and Michigan. Once introduced into an area the disease has become a problem annually. In August, **1994,** the disease was detected in Ontario in fields planted with pepper and squash.

MATERIALS AND METHODS: Observations were made on a field of commercial peppers in the vicinity of the Harrow Research Centre. Subsequently, other fields in Essex and Kent counties were surveyed for signs and symptoms of the disease. The causal organism was isolated from diseased shoots and fruit and cultured on V8 agar. Measurements of sporangia and pedicel lengths were made from cultures on solid agar. Thirteen varieties of pepper were point inoculated with an isolate from sweet pepper. Inoculum consisted of a suspension of **10,000** zoospores/ml. Peppers were incubated at **26** C for **4** days prior to rating disease severity.

RESULTS AND DISCUSSION: The field was planted with several pepper varieties and was approximately 0.5 ha in size. All plants in the field had characteristic symptoms of phytophthora crown rot and phytophthora blight. Sporangia of the fungus were evident on mummified fruit and severely infected stems. Loss was 100%. Squash fruit in an adjacent field were infected and losses exceeded 50%.

Results of a random survey of other pepper fields in Essex and Kent counties were negative.

The fungus isolated from pepper and squash was identified as P. *capsici* based on recent descriptions (Alizadeh and Tsao, **1985;** Tsao and Alizadeh, **1988).** All **13** varieties of pepper developed symptoms of phytophthora blight following inoculation. Lesions were larger in size on chili peppers but this may be due to differences in shape, size and texture compared to sweet peppers.

The presence of *P. capsici* in Ontario could be a major threat to domestic pepper production. This is especially true in the absence of suitable resistant varieties or chemical controls. Pepper and squash crops in Essex county will be monitored in **1995** for further outbreaks of the disease.

REFERENCES:

1. Alizadeh, A. and Tsao, P.H. 1985. Effect of light on sporangium formation, morphology, ontogeny, and cadacity of *Phytophthora capsici* and "*P. palmivora*" MF4 isolates from black pepper and other hosts. Trans. Br. Mycol. Soc. 85:47—69.
2. Tsao, P.H. and Alizadeh, A. 1988. Recent advances in the taxonomy and nomenclature of the so-called "*Phytophthora palmivora*" MF4 isolates occurring on cocoa and other tropical crops. Proceedings: 10th International Cocoa Research Conference. Santa Domingo, Dominican Republic. pp. 441—445.