Table 1. Residues of Oxamyl in ppm at 7 and 14 days following treatment.

	7 days	14 days
Oxamyl rate (X)	0.08, 0.05	0.05, 0.06
	0.04	0.11
	0.04	0.18, 0.20
	—	0.04
Oxamyl rate (2X)	0.07	0.14
	0.10, 0.12	0.18
	0.11	0.13
	0.13, 0.16	0.16
Control	0.003	

secticide appeared to be effective in the control of the pest but the pest population was too low to make meaningful counts and further trials are necessary. The residue levels found are low and if adequate control is achieved at these rates of application oxamyl is a useful insecticide for use on eggplant.

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A NEW RACE OF HELMINTHOSPORIUM TURCICUM AND REACTION OF SWEET CORN HYBRIDS TO THE PATHOGEN[1]

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Abstract. **In April 1979, typical northern corn leaf blight (NCLB) lesions caused by** Helminthosporium turcicum **were observed on the previously resistant sweet corn hybrids 'Guardian' and 'Florida Staysweet'. Both hybrids contain the** Ht1 **resistant gene. In greenhouse tests, isolates of** H. turcicum **recovered from 'Guardian' and 'Florida Staysweet' produced typical NCLB lesions on corn hybrids and lines with and without the** Ht1 **gene. Lines containing the** Ht2 **resistant gene were resistant to the isolates tested. This indicates that a new race (race 2) of the fungus now exists in Florida. In field tests (spring 1980) corn breeding lines containing the** HtN **gene were resistant to NCLB whereas lines containing the** Ht1 **and** Ht2 **gene were susceptible. The susceptibility of** Ht2 **lines suggests the existence of a third race of the pathogen. All sweet corn hybrids evaluated in field trials were susceptible to NCLB. However, 'Wintergreen' was the most resistant and 'Bellringer' was the most susceptible of the hybrids tested. Bellegold and Bonanza were similar to Bellringer in susceptibility. 'Guardian', 'Harris 207', 'Silverqueen', 'Florida Staysweet' and 'Iobelle' were alike in their reaction to NCLB and were moderately resistant.**

Florida is the leading state in the production of sweet corn for fresh market sales. In the 1978-79 season 54,500 acres (22,072 hectares) of sweet corn, valued at 51.4 million dollars, were harvested in the state (4). To produce this crop, 20.4% of the growing expenses, or 2 million dollars, were spent on pest control (2). As a result of the warm humid conditions that prevail in Florida, fungal diseases of sweet corn are a significant problem requiring numerous and costly fungicide applications to achieve control. Presently, northern corn leaf blight (NCLB) caused by *Helminthosporium turcicum,* is a serious disease of corn in Florida. During the late winter and spring seasons frequent fungicide applications are necessary to achieve control of the disease. In recent years sweet corn hybrids carrying the single dominant *Ht* gene for NCLB resistance have been released. Two of these hybrids 'Florida Staysweet' and 'Guardian' carry the *Ht*1 resistance gene and are commonly planted in Florida. At first these hybrids appeared to be resistant to NCLB and only the resistant-type chlorotic lesions developed in response to infection by *H. turcicum.* However, in April 1979, observations in variety trials and grower fields revealed that susceptible-type NCLB lesions were developing on 'Florida Staysweet' and 'Guardian' planted in several locations and involving different seed lots. Furthermore, disease severity on these two previously resistant hybrids was similar to that observed on hybrids lacking the resistance gene. The development of NCLB on previously resistant hybrids suggested that a new race of *H. turcicum* had developed, and was capable of overcoming the resistance conferred by the *Ht*1 gene.

The occurrence of a second race of *H. turcicum* in Florida is reported herein. Also the response of selected sweet corn hybrids to NCLB in Belle Glade, and the reaction to the natural *H. turcicum* population of corn lines carrying different resistance genes was evaluated.

Materials and Methods

Several single spore isolates of *H. turcicum* were recovered from susceptible-type NCLB lesions developing on 'Guardian' and 'Florida Staysweet'. The isolates were maintained on potato-dextrose agar slants at 20°C. To induce sporulation, for inoculation studies, newly transferred cultures were incubated in darkness for 7 to 10 days and then under light for an additional 7 to 10 days at 25°C. Spores were washed from the slants and a water suspension of approximately 2,000 spores per ml was prepared for greenhouse inoculation studies. The spore suspension was atomized onto the leaves and into the whorl of test plants in the 5- to 6-leaf stage growing in muck soil in 5″ (12.7 cm) diameter pots. Control plants were treated with tap water only. Each hybrid and line tested was inoculated in triplicate and the experiment was conducted three times. Inoculated plants and controls were covered with plastic bags and maintained at 20°C for 24 hours. The plants were moved to a greenhouse with a temperature range of 24-29°C and the bags removed.

For the *H. turcicum* race determination studies in the greenhouse, the hybrids 'Iobelle' (no *Ht* genes) 'Guardian' (*Ht*1) and 'Florida Staysweet' (*Ht*1) and the corn lines (provided by A. L. Hooker) Oh 43, Oh 43 *Ht*1, RB 37

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*Ht*1A, RH 55 *Ht*1 A, RH 55 *Ht*1 B, 14 B *Ht*2 and 14 *Ht*1/*Ht*1 *Ht*2/*Ht*2 were used.

Susceptible and resistant lesion reactions were recorded 14 days after inoculation. At that time susceptible-type lesions from the plants tested were observed for differences in sporulation activity. Leaf segments with apparently mature lesions were detached and incubated on moist filter paper in petri dishes. After 72 hours the lesions were examined under a microscope and the degree of sporulation was scored. Five replicate lesions were observed for each hybrid and line tested.

In preliminary tests all *H. turcicum* isolates recovered from 'Guardian' and 'Florida Staysweet' reacted similarly. Therefore, further tests were conducted with isolates GSS-2 (from 'Guardian') and FLSS-5 (from 'Florida Staysweet') only. An isolate designated as NYSS-1 (provided by C. W. Boothroyd) recovered from sweet corn in New York in 1974 was included in the tests.

To evaluate the reaction of selected sweet corn hybrids and lines to the natural population of *H. turcicum* a field trial was conducted. The sweet corn hybrids evaluated were 'Bellegold', 'Bellringer', 'Bonanza', 'Florida Staysweet', 'Guardian', 'Harris 207', 'Iobelle', 'Silverqueen', 'Wintergreen', XP362, XP2527, and Harris experimental hybrids 1, 2 and 3. Lines tested were Oh 43 *Ht*1, NN14 *Ht*1 *Ht*1 *Ht*2 *Ht*2, NN14B *Ht*2, BS8 74:260, (all provided by A. L. Hooker) and K64 Bc4 *Ht*N (provided by J. L. Brewbaker). The trial, conducted on a peaty muck soil at Belle Glade, was planted on March 13, 1980. Single row plots 15 ft (4.6 m) long and 3 ft (.91 m) apart were used. The corn entries were arranged in a randomized complete block design and each was replicated three times. NCLB severity ratings were made weekly starting 7 weeks after planting. Ratings were made also at full silk and maturity. A commonly used rating scale (3) of 0 to 5 (5 = severe disease) was used. During the trial, leaf samples with susceptible-type NCLB lesions were collected from selected entries and sporulation activity was determined as previously described.

Results and Discussion

In greenhouse tests, the hybrids and lines carrying the *Ht*1 resistance gene were susceptible to the *H. turcicum* isolates recovered from 'Florida Staysweet' and 'Guardian' (Table 1). Lesion development was similar on hybrids and lines with or without the *Ht*1 gene. This confirms the initial findings observed in the field.

Table 1. Reaction of corn genotypes to *H. turcicum* isolates and sporulation intensity of incubated lesions induced by isolate FLSS-5 under greenhouse conditions.[z]

Hybrid or line	*H. turcicum* isolates			Sporulation rating[y] for isolate FLSS-5
	GSS-2	FLSS-5	NYSS-1	
Iobelle	+	+	+	++
Guardian Ht1A	+	+	−	++++
Florida Staysweet Ht1B	+	+	−	++
Oh 43	+	+	+	++
Oh 43 *Ht*1A[x]	+	+		+++
RB 37 *Ht*1A	+	+		+++
RH 55 *Ht*1A	+	+		++
RH 55 Ht1B[x]	+	+		++
14B HT_2	−	−	−	0
14 $Ht_1/Ht_1/Ht_2/Ht_2$	−	−	−	0

[z]Susceptible reaction = +, Resistant reaction = −.
[y]Sporulation rating: 0 = no spores, + = few spores, ++++ = abundant sporulation.
[x]Source A resistance originally from inbred GE440, Source B resistance originally from Ladyfinger popcorn.

Under greenhouse conditions susceptible-type lesions did not develop on lines containing the *Ht*2 gene. The *H. turcicum* isolate (NYSS-1) recovered from sweet corn in New York in 1974 differed from the 'Guardian' (GSS-2) and 'Florida Staysweet' (FLSS-5) isolates by not producing susceptible-type lesions on corn containing the *Ht*1 gene. Based on the reaction of the different lines tested and the characteristics of race 2 reported by others (1, 6, 7) isolates GSS-2 and FLSS-5 correspond to race 2 of *H. turcicum* and is capable of overcoming resistance conferred by the *Ht*1 gene. Isolate NYSS-1 corresponds to the characteristics of race 1 and does not induce susceptible-type lesions on sweet corn carrying the *Ht*1 gene. Although no race 1 isolates from Florida were used in this study, the lack of susceptible-type lesion development on *Ht*1 hybrids under field conditions prior to 1979 suggests that the natural population of *H. turcicum* was primarily race 1. Presently the natural population contains both race 1 and race 2.

In sporulation studies with *H. turcicum* isolate FLSS-5, spore production was moderate on hybrids and lines with and without the *Ht*1 gene, but was somewhat higher on 'Guardian' under the conditions of this study (Table 1). This indicates that the *Ht*1 gene does not suppress sporulation of the FLSS-5 (race 2) isolate.

In the field evaluation trial the nine named hybrids tested were susceptible to NCLB, however, differences were apparent (Table 2). 'Wintergreen' was the most resistant as expressed by a reduced number of lesions compared to the other hybrids. The resistance in 'Wintergreen' is characteristic of polygenic type resistance (5). 'Bellringer', "Bellegold' and 'Bonanza' were the most susceptible in this test and a high percentage of the foliage was necrotic at maturity. 'Florida Staysweet', 'Guardian', 'Harris 207', 'Iobelle' and 'Silverqueen' were alike in their reaction to NCLB and were moderately resistant. The presence of the *Ht*1 gene in 'Florida Staysweet' and 'Guardian' had no influence on disease severity when compared to 'Iobelle' or 'Silverqueen' which lack to *Ht*1 gene.

Table 2. Reaction of sweet corn hybrids to northern corn leaf blight at full silk and maturity in a field trial.

Hybrid	Disease severity rating[z]		Seed source
	Full silk	Maturity	
Bellringer	2.3 ab[y]	4.2 a	Harris
Bellegold	2.0 abc	3.8 ab	Harris
Bonanza	1.7 bcd	3.8 ab	Ferry Morse
Iobelle	2.0 abc	3.7 bc	Asgrow
Florida Staysweet	2.5 a	3.7 bc	Univ. of Florida
Silverqueen	1.3 cd	3.5 bcd	Rogers
Guardian	1.7 bcd	3.3 cd	Asgrow
Harris 207	1.0 d	3.3 cd	Harris
Wintergreen	1.3 cd	3.2 d	Asgrow

[z]Ratings were based on a scale of 0 to 5 with 0 = no disease and 5 = most severe symptoms.
[y]Values followed by the same letter do not differ significantly at the 5% level by the Duncan's Multiple Range test.

The five numbered experimental sweet corn hybrids included in the field evaluation had significantly less NCLB when compared to the susceptible hybrid 'Bellringer' (Table 3). In addition, the five hybrids were similar in their reaction to NCLB and show potential as resistant hybrids for Florida conditions.

In the field plantings of corn lines containing the *Ht*1, *Ht*2 and *Ht*N genes (Table 4) no NCLB was observed on the line carrying the *Ht*N gene. Besides developing on the *Ht*1 line, NCLB lesions developed on lines NN14 and NN14B. Both lines contain the *Ht*2 resistance green. In addition, NN14 carries the *Ht*1 gene. The NCLB rating for

Table 3. Reaction of experimental sweet corn hybrids to northern leaf blight at full silk and maturity as compared to the hybrid 'Bellringer' in a field trial.

Experimental hybrid no.	Disease severity rating[z]		Seed source
	Full silk	Maturity	
Bellringer	2.3 a[y]	4.2 a	Harris
XP362	1.0 c	3.0 c	Asgrow
XP2527	1.3 bc	3.3 bc	Asgrow
Harris-1	2.0 ab	3.7 ab	Harris
Harris-2	1.7 abc	2.8 c	Harris
Harris-3	2.0 ab	3.2 bc	Harris

[z]Ratings based on a scale of 0 to 5 with 0 = no disease and 5 = most severe symptoms.
[y]Values followed by the same letter do not differ significantly at the 5% level by the Duncan's Multiple Range test.

NN14B and NN14 were 3.2 and 0.5, respectively. This indicates that possibly a third race of *H. turcicum* capable of overcoming resistance conferred by the *Ht*2 gene is present in the natural population. Smith (6) recently reported on a race of *H. turcicum* that was virulent on corn lines carrying the *Ht*2 and *Ht*3 genes. Furthermore, race 3 is reported to be avirulent on genotypes carrying the *Ht*1 gene (6). In the present study susceptible lesions were found on both NN14 and NN14B but to a higher degree on NN14B. Therefore, further tests are needed to establish the indentification of the race attacking NN14 and NN14B in Florida.

The findings from this study indicate that NCLB may be a difficult disease to control through breeding because of the development of new races of the pathogen which can overcome single gene resistance. For this reason development of hybrids with polygenic resistance may be a better approach to controlling NCLB in the future.

Table 4. Reaction of five corn genotypes to northern corn leaf blight at full silk and maturity in a field trial and sporulation rating of incubated lesions.

Genotype	Disease severity rating[z]		Sporulation[y] rating
	Full silk	Maturity	
Oh 43 *Ht*1 *Ht*1	1.0 a[x]	3.2 a	2.6 a
NN14B *Ht*2 *Ht*2	0.3 b	3.2 a	0.4 b
NN14 *Ht*1 *Ht*1 *Ht*2 *Ht*2	0.3 b	0.5 b	0.4 b
K64 *Ht*N bc4	0.0 c	0.0 c	0.0 b
BS8 74:260[v]	0.0 c	0.0 c	0.4 b[w]

[z]Ratings based on a scale of 0 to 5 with 0 = resistant type lesions only or no disease and 5 = severe disease.
[y]Degree of sporulation based on a scale of 0 to 5 with 0 = no spores and 5 = abundant spores.
[x]Values followed by the same letter do not differ significantly at the 5% level by the Duncan's Multiple Range test.
[w]Very limited sporulation noted in some resistant lesions.
[v]Genotype unknown.

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NEMATODES ASSOCIATED WITH SWEETPOTATO AND EDIBLE AROIDS IN SOUTHERN FLORIDA[1]

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Additional index words. Ipomoea batatas, Colocasia, Xanthosoma, Helicotylenchus dihystera, Meloidogyne javanica, Quinisulcius acutus, Rotylenchulus reniformis, cocoyam, malanga, taro, boniato, population dynamics.

Abstract. **Nematode population buildup over a 6-month period on three cultivars of white-fleshed sweetpotato—'Morado', 'Picadita', and 'White Triumph'—was compared with that on 'Carver', an orange-fleshed cultivar.** Rotylenchulus reniformis **built up to very high levels on all cultivars tested, reaching populations of 228 to 408/100cm³ of soil. Significantly (P=0.05) higher numbers of** Helicotylenchus dihystera **built up on 'Morado' and 'White Triumph' than on 'Carver' after 6 months, while significantly (P=0.05) lower numbers of** Quinisulcius acutus **occurred on 'Morado' than on 'Carver' at that time. Despite these differences, populations of all three nematodes had multiplied several times on all cultivars over the 6 month test period. Nematode samples collected from two genera of edible aroids revealed extremely high populations of** R. reniformis, **averaging 556/100 cm³ of soil for** Colocasia **spp. and 528/100 cm³ for** Xanthosoma **spp. Other plant parasites associated with these crops included** H. dihystera, Q. acutus **and** Meloidogyne javanica.

Important subtropical root crops grown in southern Florida include the boniato, or white-fleshed sweetpotato (*Ipomoea batatas* L.) and edible aroids (*Colocasia* spp. and *Xanthosoma* spp.). Approximately 3645 ha were planted to these crops in 1978 (9). Little is known of the nematode problems on these crops in southern Florida. Root knot nematodes (*Meloidogyne* spp.) have been reported on *Colocasia* spp. and *Xanthosoma* spp. in various parts of the world (2, 3, 5, 8, 10), and high numbers of *Rotylenchulus reniformis* Linford and Oliveira were found associated with *X. sagittifolium* in Trinidad (3). Previous work on nematode damage to the sweetpotato by *Meloidogyne* spp. and

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