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ABSTRACT

Fargette, D., Lister, R. M., and Hood, E. L. 1982. Grasses as a reservoir of barley yellow dwarf virus in Indiana. Plant Disease 66:1041-1045.

About 50% of the grass samples collected in Indiana during the summer of 1980 were infected with barley yellow dwarf virus (BYDV) according to enzyme-linked immunosorbent assay. The isolates distinguished by the tests resembled PAV (nonspecifically transmitted by *Rhopalosiphum padi* and *Macrosiphum avenae*), MAV (specifically transmitted by *M. avenae*), or RPV (specifically transmitted by *R. padi*). Results indicated that there is a large reservoir of BYDV in perennial grasses in Indiana but that this may not be the most important source of inoculum for spread to cereals. For example, RPV-like isolates were the most prevalent type in grasses at the Purdue University Agronomy Farm, but samples from winter wheat and spring oats collected there were infected mostly with PAV-like isolates. In addition, grasses around a plot where wheat artificially infected with a PAV-like isolate had been grown for several seasons showed very few PAV-like infections. Other possible sources of BYDV, including corn (*Zea mays*), need investigation in relation to epidemiology in cereals.

ammonium sulfate or sodium sulfate, followed by resuspension in phosphate-buffered saline (PBS), pH 7.4, and dialysis against two 1-L lots of PBS.

The Ig's at 1 mg of protein per milliliter ($A_{280} = 1.4$) were conjugated with alkaline phosphatase (Type VII, Sigma Chemical Co., St. Louis, MO) at an enzyme/Ig ratio of 5:3 (w/w) by treatment with 0.06% glutaraldehyde (4 hr at room temperature) and were stored at 4 C with an equal volume of bovine serum albumin at 10 mg/ml containing 0.04% sodium azide.

Methods for ELISA were essentially as described by Clark and Adams (3). Wells in polystyrene micro-ELISA plates

(A_{405}) of well contents directly or after

being pulverized in liquid nitrogen was

maintained in an insect-free greenhouse.

Table 1. Barley yellow dwarf virus (BYDV) infections detected by enzyme-linked immunosorbent assay in samples of grasses and cereals from various locations in Indiana

Location	Host	No. tested/infected	Percentage infected	BYDV type detected			
				RPV	PAV	MAV	RPV + PAV
Purdue Farm general survey	*Poa pratensis*	138/75	54	71	3	1	0
	Festuca arundinacea	29/6	21	2	1	3	0
	P. pratensis + *F. arundinacea*	16/7	44	2	4	0	1
	P. pratensis + other species[a]	3/2	...	2	0	0	0
	F. arundinacea + other species	1/0	...	0	0	0	0
	Other species	15/5	33	1	0	2	2
	Total	202/95	47	78	8	6	3
Purdue Farm field 11	*P. pratensis*	30/9	30	9	0	0	0
	P. pratensis + *F. arundinacea*	8/7	88	7	0	0	0
	P. pratensis + other species	2/1	...	0	1	0	0
	Other species	1/1	...	0	1	0	0
	Spring oats	54/41	76	6	31	3	1
	Winter wheat	14/14	100	0	9	0	5
Purdue Farm field 41	Winter wheat	6/5	83	2	3	0	0
Purdue Farm field 63	Spring oats	26/9	35	1	8	0	0
Lafayette area (lawns)	Grasses[b]	83/47	57	39	5	0	3
Indianapolis (NE)	Grasses	14/3	21	0	3	0	0
Indianapolis (SW)	Grasses	7/6	86	1	4	0	1
Michigan City	Grasses	7/7	100	0	7	0	0
Vincennes	Grasses	9/6	67	5	0	0	1

[a] Annuals: *Bromus commutatis* Schrad., *B. japonicus* Thunb., *B. tectorum* L., and *Setaria viridis* (L.) Beauv.; perennials: *B. inermis* Leyss., *Dactylis glomerata* L., *Festuca rubra* L., *Phleum pratense* L., and *Poa compressa* L. Infections were detected in *B. tectorum, F. rubra,* and *P. pratense.*
[b] Various species, mainly *Poa pratensis.*

collected in mid-June to little more than two times background for some samples collected in late July. This effect was associated with reduction in vegetative growth during warm and dry conditions. By contrast, ELISA values for field-collected cereal samples tended to increase through the survey period, ranging from about five times background for June samples to 10–12 times background for July samples, which included some samples consisting of dry senescent leaves.

Table 2 illustrates the serological relationship as determined by ELISA among the BYDV isolates used as standards during the survey. Neither MAV nor P-PAV Ig's detected the RPV antigen, a result consistent with previous findings of nonrelationship between RPV and the two other isolates (1). The P-PAV antigen reacted with MAV Ig, but not as strongly as with the homologous P-PAV Ig. However, the P-PAV Ig did not give positive reactions with the MAV antigen. Similarly, heterologous reactions occurred with most, but not all, of the PAV-like antigens found during the survey and the MAV Ig, but they were always less intense than the "homologous" reactions with P-PAV Ig.

According to previous reports (10,19), heterologous reactions between the authentic (Cornell) type PAV antigen and MAV sera in ELISA tests are relatively weak compared with reactions using type PAV and its antiserum. This effect was confirmed in our tests (Table 2), which also showed that the P-PAV Ig reacted less efficiently with type PAV

Table 2. Homologous and heterologous reactions of barley yellow dwarf virus (BYVD) preparations in enzyme-linked immunosorbent assay[a]

Antigen	Immunoglobulin		
	MAV	P-PAV	RPV
		Experiment 1	
MAV	1.64	0	0.22
P-PAV	1.89	2.20	0
RPV	0	0	1.37
		Experiment 2	
MAV	1.12	0.04	...[b]
P-PAV	1.38	2.24	...
PAV	0.24	0.80	...

[a] Values obtained in reactions of extract from oat infected with the MAV, P-PAV, PAV, or RPV isolates of BYDV, using the immunoglobulin indicated as coat and conjugate. Values for control extracts from healthy plants have been subtracted.
[b] Not tested.

than with P-PAV antigen, suggesting that the P-PAV differs from the type PAV in its degree of relationship with type MAV.

This and the fact that some of the PAV-like isolates from grass samples reacted with MAV Ig less strongly than P-PAV, or not at all, suggests that a range of PAV-like isolates occurs in the state. This is consistent with the situation found in surveys elsewhere (Rochow, *personal communication*).

Purdue Farm surveys. Of a total of 202 samples tested in the systematic general survey of grasses at the Purdue Farm, 95 indexed positive for BYDV (Table 1). Infections were distributed fairly uniformly over the area surveyed (Fig. 1). *Poa pratensis* L. (Kentucky bluegrass) and *Festuca arundinacea* Schreb. (tall fescue), the two most commonly occurring perennial grasses, frequently indexed positive; however, BYDV was identified in several other species, including annuals and perennials (Table 1). In a few cases, the source of virus in a test sample was unknown because the samples included mixtures of grass species. Isolates of the RPV type occurred in 81 of the 95 infected samples. Eleven samples contained PAV-like isolates and six contained MAV-like isolates.

Early in the survey, six of the artificially infected wheat plants selected at random in the NE 11 area were sampled for ELISA. Each indexed positive only for BYDV of the PAV type. During June and July, some of the noninfested wheat plants in the NW 11 area showed symptoms suggesting BYDV infection; 14 of these plants, selected at random and representing about one-half of those seen, assayed positive for BYDV of the PAV type, and five also

[redacted]

dwarf virus. Virology 46:117-126.
19. Rochow, W. F., and Carmichael, L. E. 1979. Specificity among barley yellow dwarf viruses in enzyme immunosorbent assays. Virology 95:415-420.
20. Rochow, W. F., and Muller, I. 1971. A fifth variant of barley yellow dwarf virus in New York. Plant Dis. Rep. 55:874-877.
21. Rochow, W. F., and Muller, I. 1974. Mixed infections of barley yellow dwarf virus isolates in winter grains. Plant Dis. Rep. 58:472-475.
22. Slykhuis, J. T., Zillinsky, F. J., Young, M., and Richards, W. R. 1959. Notes on the epidemiology of barley yellow dwarf virus in eastern Ontario in 1959. Plant Dis. Rep. Suppl. 262:317-322.
23. Stoner, W. N. 1977. Barley yellow dwarf virus infection in maize. Phytopathology 67:975-981.
24. Wallin, J. R., Peters, D., and Johnson, L. C. 1967. Low-level jet winds, early cereal aphids and barley yellow dwarf detection in Iowa. Plant Dis. Rep. 51:527-530.

Host Range of the Columbia Root-Knot Nematode

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ABSTRACT

O'Bannon, J. H., Santo, G. S., and Nyczepir, A. P. 1982. Host range of the Columbia root-knot nematode. Plant Disease 66:1045-1048.

The Columbia root-knot nematode, *Meloidogyne chitwoodi,* a severe pest of potato in the Pacific Northwest, reproduced on 53 of 68 plant species tested under greenhouse conditions. Both monocotyledonous and dicotyledonous plant species were good hosts, indicating that *M. chitwoodi* has a wide host range. Principal crops used in rotation with potato in the Pacific Northwest include a poor host (alfalfa), but cereals such as barley, corn, and wheat were good hosts for this nematode.

An undescribed root-knot nematode was found attacking potato (*Solanum tuberosum* L.) in the Pacific Northwest in 1977–1978 (9). The new species was described as *Meloidogyne chitwoodi* Golden, O'Bannon, Santo, and Finley (4) and given the common name "Columbia root-knot nematode." It is presently known in Idaho, Oregon, Washington, [illegible]

seeds, later thinned to one or two seedlings or a single seed piece, were either pregerminated or planted directly into 10-cm plastic pots containing loamy sand (82.3% sand, 14.8% silt, 2.9% clay) fumigated with methyl bromide. Pots were randomized in five replicates on greenhouse benches, and plants were inoculated after 2- or 3-wk growth with [illegible]

<100 eggs per gram of root, very poor host; 1.1–2 = light reproduction, 100–1,000 eggs, poor host; 2.1–3 = moderate reproduction, >1,000–10,000 eggs, moderate host; 3.1–4 = high reproduction, >10,000–100,000 eggs, good host; 4+ = very high reproduction, >100,000 eggs, very good host.

Because several plants observed in our studies are grown in a rotation program, we tested several varieties within a species to ascertain the possible existence of resistant germ plasm or nematode-tolerant cultivars.

RESULTS AND DISCUSSION

M. chitwoodi was found to infect and reproduce on 53 of 68 plant species tested, indicating a wide host range (Table 1). Unlike *M. hapla* (2), many of the Gramineae as well as many dicotyledonous [illegible]