# Incidence of Western Corn Rootworm Beetles (Coleoptera: Chrysomelidae) on Corn in Virginia from 1987 to 1992[1]

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**ABSTRACT** The discovery of western corn rootworm beetles, *Diabrotica virgifera virgifera* LeConte, in a southwest Virginia corn field in 1985 prompted annual surveys of corn fields in an average of 28 counties across the state from 1987 to 1992. All counties included in the annual surveys were representative of the major corn-growing regions of Virginia. Survey results indicated that western corn rootworm beetles spread rapidly throughout most of the western and central continuous corn-growing regions of the state. In the eastern and southeastern corn-growing regions of the state, where crop rotation is widely practiced, detections of western corn rootworm beetles were less common and typically involved only one to two counties per year from 1987 to 1992.

**KEY WORDS** Insecta, *Diabrotica virgifera virgifera,* corn, survey, crop rotation.

The western corn rootworm, *Diabrotica virgifera virgifera* LeConte, is one of the most destructive insect pests of continuous corn production in the Midwest (Chiang 1978). The life history and damaging characteristics of this pest, as well as the extent of its geographic range throughout the Midwest corn belt, has been reviewed by Chiang (1973). The first record of the western corn rootworm in the U.S. was made in Kansas in 1868 (LeConte 1868). According to Chiang (1973), the geographic distribution of the western corn rootworm up to 1955 was limited to Nebraska and portions of Kansas, Colorado, Iowa, and South Dakota. Since 1955, the western corn rootworm has expanded its range to the point where it has been detected throughout virtually all of the Midwest corn belt.

Although the northern corn rootworm, *Diabrotica barberi* Smith and Lawrence, has been known to occur in Virginia since 1971 (W. A. Allen, unpublished data), reports of corn rootworm damage in continuous corn fields (i.e., fields in which corn typically is planted for two or more years in a row) in Virginia were uncommon before 1985. It was only after the western corn rootworm was detected in Virginia that reports of corn rootworm damage in continuous corn fields began to increase.

The first record of the western corn rootworm in Virginia was made in 1985 (D. J. Hilburn, unpublished data) from beetles collected in a continuous corn field in Washington Co. (Figures 1 and 2). The beetles were sent to the Insect Identification Laboratory (IIL) at Virginia Polytechnic Institute and State University where they were identified as the western corn rootworm.

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Fig. 1. County map of Virginia.

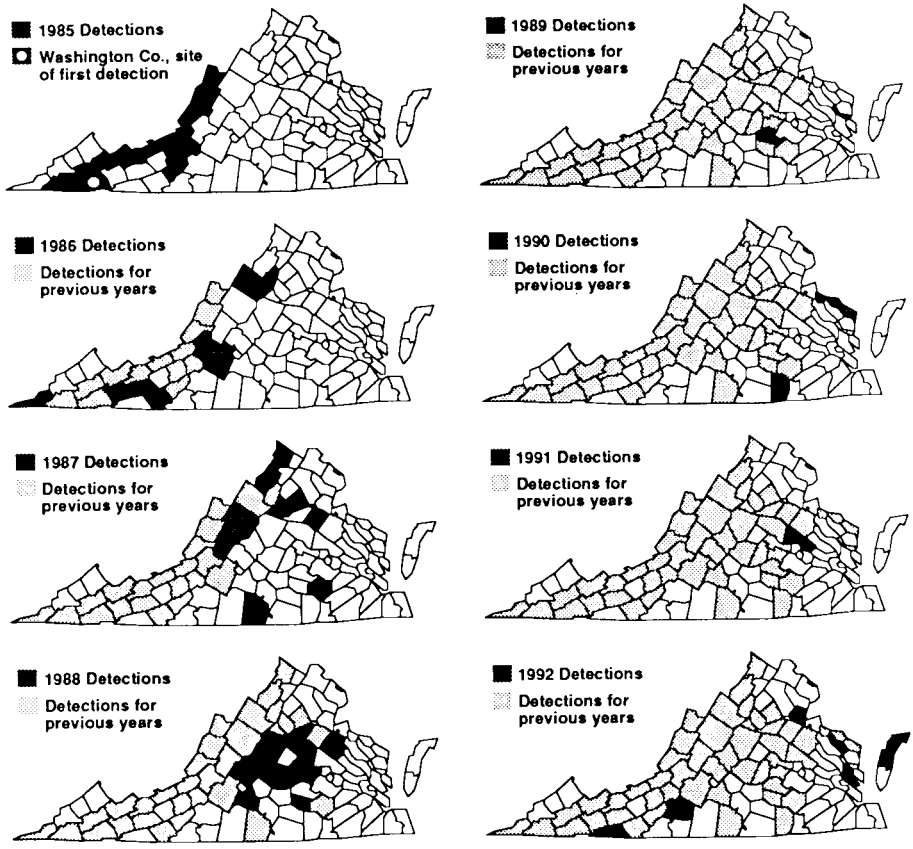


Fig. 2. Annual detections of western corn rootworm beetles on corn in Virginia from 1985 to 1992.

Washington Co. is located in southwestern Virginia and is one of several western Virginia counties where continuous corn production is widely practiced.

Immediately following the initial discovery of the western corn rootworm in Virginia, corn fields in other nearby counties of western and southwestern Virginia were surveyed by IIL personnel to determine the extent of the infestation. In all, western corn rootworm beetles were detected in thirteen counties in 1985 (Fig. 2). Although no active western corn rootworm surveys were made in 1986, western corn rootworm beetles received by the IIL that year resulted in eight new county records for western and southwestern Virginia (Fig. 2).

One of the main assumptions of our study was that the initial infestation of the western corn rootworm in Virginia occurred in a continuous corn field of western or southwestern Virginia, and that the subsequent spread of the western corn rootworm has been from west to east. Therefore, to determine the

incidence of the western corn rootworm in the major corn-growing regions of Virginia from 1987 to 1992, western corn rootworm survey efforts were expanded by including counties across the state from which western corn rootworms had not been detected previously. Although limited resources prevented us from surveying all possible counties, those used represented the predominant continuous and rotated corn growing regions of western and eastern Virginia, respectively.

## Materials and Methods

From 1987 to 1992, corn fields in representative counties across the state were surveyed for western corn rootworm beetles during the last week of July. A maximum of three corn fields per county were surveyed if no western corn rootworm beetles were detected in either of the first two fields. Approximately 50 corn plants along a U-shape pattern in each field were inspected for the beetles. Field selection was arbitrary and usually coincided with access to main highways. Except where noted, no attempt was made to determine the cropping or insecticide-use history of these fields. The presence of a single western corn rootworm beetle in a county constituted a detection record for that county, and counties in which western corn rootworms were detected were excluded from subsequent surveys.

Three general corn-growing areas of Virginia were surveyed in 1987. The western and north-central survey area consisted of the following eight counties: Rockbridge, Augusta, Albemarle, Greene, Madison, Culpeper, Orange, and Spotsylvania. The south-southeastern survey area consisted of twelve counties located south of the James River: Campbell, Appomattox, Prince Edward, Nottoway, Dinwiddie, Prince George, Surry, Sussex, Southampton, Isle of Wight, City of Suffolk, and City of Chesapeake. The eastern survey area consisted of thirteen counties located north of the James River in the lower (James City, York, and New Kent), middle (King William, King and Queen, Gloucester, Mathews, Middlesex, and Essex), and upper peninsulas (Richmond, Lancaster, Northumberland, and Westmoreland).

The western and north-central survey area used in 1987 was changed in 1988 to a more central survey area of the state which consisted of the following eleven counties: Amherst, Nelson, Albemarle, Orange, Louisa, Caroline, Fluvanna, Goochland, Buckingham, Cumberland, and Powhatan. The 1987 south-southeastern and eastern survey areas were unchanged and used again in 1988.

The counties surveyed in the 1987 south-southeastern and eastern survey areas essentially were repeated from 1989 to 1992. However, in 1989 the south-southeastern survey area was modified to include several counties along the border of North Carolina which had not been surveyed previously. Thus, from 1989 to 1992 the south-southeastern survey area included the following new counties: Patrick, Henry, Pittsylvania, Mecklenburg, Brunswick, Greensville, and City of Virginia Beach, as well as the previously surveyed counties of Prince George, Surry, Sussex, Southampton, Isle of Wight, City of Suffolk, and City of Chesapeake. Amelia Co., which is located in the south-central area of Virginia, also was included in the south-southeastern survey area in 1989. In 1991, Hanover Co. was included in the eastern survey area.

## Results

Of the western and north-central areas surveyed in 1987, western corn rootworm beetles were detected in all counties except Albemarle and Orange (Fig. 2). In contrast, Dinwiddie was the only county in the south-southeastern survey area in which western corn rootworms were detected. Moreover, no western corn rootworms were detected in any of the thirteen counties of the eastern survey area. Additional western corn rootworm detection records for 1987 that resulted from western corn rootworm beetles received by the IIL, and which were not part of any of our survey areas, included Halifax Co., located on the North Carolina border, and Shenandoah and Frederick counties in the northwestern corner of Virginia.

In 1988, western corn rootworm beetles were detected in ten of the eleven counties of the central survey area; Fluvanna Co. was the exception (Fig. 2). Of the counties surveyed in the south-southeastern area, only Campbell and Nottoway resulted in new western corn rootworm detection records for 1988. Also, in 1988, no western corn rootworms were detected in the eastern survey area.

For the period from 1989 to 1992, western corn rootworm beetles were detected in a total of eight counties in the south-southeastern and eastern survey areas (Fig. 2). Specific counties in which western corn rootworms were first detected during that period included: Amelia and Middlesex in 1989; Brunswick, Westmoreland, and Northumberland in 1990; Hanover in 1991; and Gloucester and Richmond in 1992. It should be noted that the western corn rootworm detections for Middlesex, Westmoreland, and Northumberland counties involved fields in which corn had been grown the previous year. Additional western corn rootworm detection records for 1992 that resulted from western corn rootworm beetles received by the IIL, and which were not part of either of our survey areas included Franklin and Grayson counties in southwestern Virginia, Stafford Co. in northern Virginia, and Accomack Co. on the Eastern Shore (i.e., the Delmarva Peninsula).

## Discussion

The results of our annual western corn rootworm surveys support the hypothesis that western corn rootworm beetles spread rapidly throughout most of the western and central continuous corn-growing regions of Virginia. Indeed, western corn rootworms were detected in sixteen (84.2%) of the nineteen western, central, and north-central counties in the 1987 and 1988 survey areas. In contrast, western corn rootworm detections from 1987 to 1992 in the eastern and southeastern regions of the state involved only one to two counties per year (i.e., Dinwiddie in 1987; Caroline in 1988; Middlesex in 1989; Northumberland and Westmoreland in 1990; Hanover in 1991; and Gloucester and Richmond in 1992), despite the fact that approximately twenty counties in these regions were surveyed annually. These results were not surprising given the difference in continuous versus rotated corn production practices across the state. A separate, statewide survey of corn producers in 1989 revealed that approximately 61% of the reported corn acreage in the western, central, and

north-central areas of the state for the 1988 cropping year had been planted in corn since at least 1986 (R. R. Youngman, unpublished data). In contrast, corn producers in the eastern and southeastern areas of the state reported that approximately 92% of the 1988 corn acreage was rotated with other crops.

The possibility that a more intensive survey method would have detected western corn rootworm beetles in additional counties of Virginia cannot be ruled out; however, the results support the hypothesis that western corn rootworms occur much less frequently in areas where crop rotation is widely practiced, for example, the coastal plain region of eastern Virginia. Typical crops with which corn is annually rotated in Virginia's coastal plain include soybeans, small grains, and peanuts. Because western corn rootworm larvae do not survive on the roots of these crops, rotating corn with such crops effectively prevents the development of western corn rootworm populations.

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## References Cited

**Chiang, H. C.** 1973. Bionomics of the northern and western corn rootworms. Annu. Rev. Entomol. 18: 47-72.

**Chiang, H. C.** 1978. Pest management in corn. Annu. Rev. Entomol. 23: 101-123.

**LeConte, J. L.** 1868. New Coleoptera collected on the survey for the extension of the Union Pacific Railway, E. D. from Kansas to Fort Craig, New Mexico. Trans. Am. Entomol. Soc. 2: 49-59.