VIRUS DISEASES OF CEREALS AND VECTOR POPULATIONS IN THE CANADIAN PRAIRIES DURING 1965[1]

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Introduction

These observations are based mainly on weekly surveys during spring and summer in south-central Manitoba, supplemented by surveys to Saskatchewan, Alberta, and other areas of Manitoba in August.

Aster yellows virus

The six-spotted leafhopper, Macrosteles fascifrons (Stål), the chief vector of aster yellows virus (AYV), was much less abundant than usual. The spring migration of leafhoppers into Manitoba was somewhat smaller than in recent years and there was a very small summer population. Six % of the leafhoppers, rnainly migrants, tested in early June were carrying AYV. In late June and early July the figure was 2%.

Although the percentage of viruliferous individuals in the population was high, particularly early in the season, there was only a trace of aster yellows in barley in southern Manitoba because of the small population of leafhoppers. A survey late in the season also indicated only a trace of AYV on barley in Saskatchewan and Alberta.

Barley yellow dwarf virus

Populations of aphid vectors for this virus were very low during the early part of the season, and appeared to consist almost exclusively of migrant English grain aphids, Macrosiphum avenae (Fabricius). During the second week of May, this species was found in fielc's of winter rye before the spring cereals had germinated. Population numbers rose, chiefly by local increase, from one per 50 sweeps to about 10 per 50 sweeps by the middle of June, and thereafter, assisted by additional migrants, at an increasingly rapid rate. By the end of July, counts for this species on spring cereals were as high as 410 per 50 sweeps, equivalent to an average of 7 per plant on oats in head.

The first corn leaf aphids, Rhopalosiphum maidis (Fitch), and rose grass aphids, Metopolophium dirhodum (Walker), were found on barley at the end of the first week in July, and the first grtenbugs, Schizaphis graminum (Rondani), and cherry oat aphids, Rhoalosiphum padi (Linnaeus), on oats during the third week of July.

The aphid populations reached their peak density by the end of July and the first week in August, and then declined rapidly to relatively low numbers by the end of August. During theperiod of highest aphid populations, the English grain aphid was the dominant species on wheat and oats and frequently also on barley. The corn leaf aphid was occasionally the most numerous species on barley. Populations of greenbugs and rose grass aphids were very low by comparison, and the cherry oat aphid was scarce.

Eleven % of the English grain aphids sampled from winter rye during May arid June were carrying barley yellow dwarf virus. No virus was transmitted by limited nurnbers of English grain aphids collected from spring cereals in June and early July. Four % of the corn leaf aphids collected from barley during July were found to be carrying a weak strain of the virus.

Successive batches of oat seedlings, exposed for weekly intervals in the field as bait plants for the aphids, showed a sharp peak in the rate of infection for the virus at a time that coincided with that for peak densities in aphid populations, namely during the last week in July and the first week in August.

There was generally only a trace of the disease in most of the 70 commercial fields of spring cereals examined. However, in one area east of Riding Mountain, from Dauphin to Neepawa, where crops were not as advanced as in other areas, aphid populations were exceptionally heavy, and disease incidence on oats and barley was occasionally as high as 90%.

Oat blue dwarf virus

This disease was first reported in Canada in 1964 from an experimental plot near Winnipeg (Can. Plant Dis. Surv. 45: 45). This disease was probably present in Manitoba previous to this, since it was reported earlier from Minnesota (1, 3). During 1965, a few very stunted plants with short, dark-green leaves and considerable blasting of the florets were found in an oat field near Swan River, Manitoba. Transmission of the virus was obtained by the six-spotted leafhopper, Macrosteles fascifrons (Stål), onto oats, where symptoms typical of the virus developed. The disease appeared to be rare in Manitoba during 1965, but diseased plants may be readily overlooked because they are often obscured by taller, healthy plants.

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Wheat striate mosaic virus

A few diseased plants were found in one wheat field in the extreme southern part of Manitoba near Morden. No further examples of this disease were seen in numerous othsr wheat fields. The identity of this disease was confirmed by transmission of the virus by the painted leafhopper, Endria inimica (Say) (4) to test wheat seedlings. The very low incidence supports previous observations (2) and the findings in a recent biological study of the vector (5) that this disease may never be severe in !he eastern Canadian prairies.

Barley stripe mosaic virus

This disease was not observed in any of the numerous commercial fields examined. However, the virus was isolated from barley in experimental plots at Winnipeg and Portage la Prairie where infection was occasionally very high. These isolates caused a severe disease on 'Minter' and 'Selkirk' wheat and on 'Parkland' and a black-hulless barley, following mechanical inoculations in the greenhouse. Systemic infection was also obtained on 'Golden Bantam' sweet corn, and localized infection on 'Klein Wanzleben' sugar beet. No infection was obtained on 'Clintland' or 'Rodney' oats, 'Betzes' barley or 'Bloomsdale Savoy' spinach.

A virus disease of oats

A disease not previously described from Manitoba was found in one field of 'Russell' oats near St. Pierre in August, 1965. Diseased plants occurred most commonly near the margin of the field though isolated plants with symptoms were also scattered within the field. The crop was in the green, headed stage when the disease was first observed.

Symptoms consisted of necrosis on leaf blades and sheaths and a green mosaic of non-necrotic areas. The necrosis and green mosaic were apparent on leaves of all ages. Affected plants showed noticeable stunting and blasting of the florets.

When test seedlings of 'Russell' oats at the two-leaf stage were inoculated with sap from crushed leaves of the diseased plants, systemic symptoms developed nine days after inoculation at about 20°C. Initially, chlorotic lines of variable length, parallel with the veins, occurred on young leaves. Later this chlorosis developed into an irregular mottle, and with further aging, necrotic lines and irregularly shapednecrotic areas appearedon the mottled leaves. Necrosis became more extensive as the plant aged, and dark-green islands often remained in the middle of extensive necrotic areas. Infected plants showed no tendency to recover from symptoms.

All of 10 varieties of oats mechanically inoculated with the virus were susceptible, but none of 14 barley and 14 wheat varieties showed symptoms and no virus was recovered from the inoculated plants. The total infection rate on oats, using the rubbing method with corundumpowder and 1% K_2HPO_4 averaged 88% for 10 plants of each of the 10 varieties inoculated. No transmission was obtained from oats to oats with the six-spotted leafhopper, the painted leafhopper, or with 5 species of aphids that commonly infest the small grains.

Although numerous oat fields in Manitoba and eastern Saskatchewan were examined during the season, no other examples of this disease were found. Work is now proceeding to characterize the virus.

literature cited

1. Banttari, E. E. and M. B. Moore. 1959. The cause and transmission of blue dwarf of oats and of two kinds of dwarfing in barley. (Abstr.) Phytopathology 49: 533.
2. Hagborg, W. A. F. 1963. Wheat striate mosaic, a sword of Damocles hanging over the western wheat grower - or not? Can. Plant Dis. Survey 43: 194-195.
3. Moore, M.B. 1952. The cause and transmission of blue dwarf and red leaf of oats. (Abstr.) Phytopathology 42: 471.
4. Slykhuis, J.T. 1953. Striate mosaic; a new disease of wheat in South Dakota. Phytopathology 43: 537-540.
5. Westdal, P. H. (unpublished).