Transmission of Barley Yellow Dwarf Virus by Different Stages of the Greenbug

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ABSTRACT

Two barley yellow dwarf virus isolates for which the aphid, *Schizaphis graminum*, was the only (isolate 6718) or the most efficient (isolate 6711) vector were transmitted more efficiently by nymphs of *S. graminum* than by adults. Persistence of isolate 6711 in the aphid was low. *Schizaphis graminum* nymphs also transmitted a nonspecific isolate (6515) more efficiently than adults. Phytopathology 61:749-750.

Results of previous studies indicated either that nymphs and adults were equally efficient as vectors (1, 7, 8), or that nymphs were less efficient than adults (D. L. Sana, & J. T. Shultz, *personal communication*). These studies were made with isolates of barley yellow dwarf virus (BYDV) transmitted specifically by *Macrosiphum avenae* (Fabricius) or *Rhopalosiphum padi* (Linnaeus), or with isolates transmissible by both (nonspecific).

Schizaphis graminum (Rondani) is either the only vector, or the most efficient vector among five species of aphids for several isolates of BYDV in Manitoba (2, 3). The proportion of plants infected with these isolates was low when *S. graminum* adults were used. Recently an *R. maidis*-specific isolate of BYDV was found to be transmitted more efficiently by *R. maidis* (Fitch) and *S. graminum* nymphs than by adults (4). We wished, therefore, to determine whether a similar relationship existed between the different stages of *S. graminum* and two *S. graminum*-specific isolates. For comparison, the transmission of a nonspecific isolate by *R. padi* and *S. graminum* was also studied.

The greenbug, *S. graminum*, and the cherry oat aphid, *R. padi* were used. Methods for rearing the clones and for deriving 12-hr-old nymphs and mature, 10-day-old apterous aphids have been described (4). Aphids from the colonies were tested regularly to ensure that they were virus-free. Virus isolates were 6515, nonspecific (NS) (2); and 6711 (S-NS) and 6718 (S-S), both *S. graminum*-specific (3). Isolates were maintained in oats, *Avena byzantina* K. Koch 'Coast Black'. Virus source plants were Coast Black oats inoculated at the 1- to 2-leaf stage and used 10-15 days after the inoculation. Nymphs and adults were then caged together on one leaf of the virus source plant at 15 C. After 2 or 4 days, aphids were removed and caged individually on Coast Black test seedlings. In experiments involving daily serial transfers, each aphid was moved to a second caged seedling after 24 hr, the transfers continuing until the aphid died or the experiment was concluded, usually on the 20th day.

The serial transmission pattern of isolate NS was examined with 10 adults each of *S. graminum* and *R. padi*. Ten serial transfers were made per aphid after a 2-day acquisition feed. Only two *S. graminum* adults became infective, each transmitting virus to only one plant, one on day 1, the other on day 4. All *R. padi* adults were infective and 72% of 89 seedlings became infected. This confirms findings of Rochow (6) and Dizon (1), that *R. padi* adults transmit nonspecific BYDV isolates efficiently, and of Dizon (1) that only a small proportion of *S. graminum* adults transmits these isolates, and then only rarely.

Isolates for which *S. graminum* was either the sole (S-S) or the most efficient (S-NS) vector were then tested in the same way as above. With isolate S-S and a 4-day acquisition feeding period, 15 nymphs and 15 adults, transferred for 20 days, transmitted virus to 10 and 1.5% of the test plants, respectively. The eight nymphs and four adults that became infective transmitted virus at erratic intervals. With nymphs, more plants became infected early in the series than with adults. The general infection pattern for this isolate was confirmed in a second trial. Five of 10 nymphs and two of 10 adults became infective during 10 transfers, and infected 9% and 2% of the plants, respectively.

With isolate S-NS and a 2-day acquisition feed, 3 of 4 nymphs and 5 of 15 adults became infective in one trial. In a second trial, 9 of 12 nymphs and 2 of 8 adults became infective; in a third trial, 8 of 10 nymphs and 3 of 10 adults became infective. In the three trials, therefore, 77% of the nymphs and 30% of the adults became infective. Aphids that became infective as nymphs transmitted virus to a larger proportion of the total number of plants as nymphs (25%) than as adults (4%). Each of the 59 aphids tested survived 20 serial transfers, but none caused infection beyond the 10th day. Transmissions again occurred at erratic intervals.

The two stages of *S. graminum* and *R. padi* were compared as vectors for isolate NS in single transfer experiments. Young nymphs and apterous adults were selected from regular colonies. After an acquisition feeding period of 3 days, the stages of each species were caged separately, three aphids/Clintland oat seedling. After 3 days, the aphids were sprayed with insecticide. In one trial with *S. graminum*, 12 of 18 plants infested with nymphs and 1 of 19 plants infested with adults became infected. In another trial, the proportions were 13 of 15 and 5 of 20 plants, respectively. In both trials, all of 8 plants infested with nymphs and all of 9 plants infested with adults of *R. padi* became infected.

Because most infections with isolate S-NS occurred early in the sequence of serial transfers, and no infections occurred beyond the 10th day, this isolate, although circulative, may perhaps multiply little if at all in the vector. Lack of evidence for multiplication of

an isolate of BYDV in *M. avenae* has recently been reported (5).

The poor transmissibility of isolates S-S and S-NS may explain why this type of isolate has not been found more commonly in the field. Our finding that *S. graminum* nymphs transmitted isolate NS more efficiently than adults conflicts with the results of Dizon (1), who found no difference between the two stages in the transmission of a nonspecific isolate from New York. The different clones of *S. graminum* and virus isolates that were used might explain this discrepancy.

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