The ideal method of controlling virus diseases of clovers is to use resistant varieties and there is evidence that such varieties can be developed.

Hutton and Peak (9) found wide differences in reactions of 51 varieties of subterranean clover (Trifolium subterraneum L.) to bean yellow mosaic virus (BYMV). They reported that resistance was due to a lethal reaction which was heritable, and dominant in most cases, and concluded that development of varieties with resistance to BYMV should be relatively easy. Neitzel (12) observed differences among strains of red clover (Trifolium pratense L.) and alsike clover (T. hybridum L.) in susceptibility to diseases thought to be incited by red clover vein-mosaic virus (RCVMV) and pea common mosaic virus (PCMV). Hanson and Hagedorn (7) compared reactions of 1 clone from each of 10 varieties of red clover to Wisconsin isolates of alfalfa mosaic virus (AMV), Wisconsin pea streak virus (WPSV), and RCVMV. They found that red clover plants differed greatly in reactions to these viruses and concluded that resistant plants existed in present varieties.

Malm (8) found resistance to virus diseases in red clover to be heritable, and probably a quantitative character.

Diachun and Henson (1) reported diverse genetic reactions in red clover to BYMV and suggested the possibility of developing resistant lines from clones selected for immunity, a high degree of tolerance, or perhaps hypersensitivity. They inoculated several hundred clones, each with one isolate of BYMV and found that local lesions were produced in some clones; in a few of the latter, the virus was confined within the local lesions and they considered such clones useful sources of resistance (2). Some clones developed no symptoms after inoculation with four isolates of BYMV (3). By selecting symptomless plants after inoculation and crossing these, they produced a population of near-isogenic lines from stocks used to produce Lakeland), C-200 (a synthetic of selected lines of Dollard), C-201 (a synthetic of selected lines of Dollard), and 'Wisconsin common'. Breeding lines were C-199 (a synthetic of Dollard), 'Wisconsin common', and 'Purdue', except clone 24, which was a virus-free selection from a field of Dollard. They found resistance to virus diseases in red clover to be heritable, and probably a quantitative character.

Wilcoxson and Peterson (14) noted a lower incidence of virus disease in 'Dollard' than in 'Wegener' red clover under field conditions, but found the two varieties equally susceptible when inoculated mechanically. They concluded that the difference in field reaction was due in attractiveness to the pea aphid (Acyrthosiphon pisum (Harris)) vector. They suggested that breeding less attractive to aphids might be a more effective approach than breeding for resistance to viruses.

The primary purpose of this study was to determine the variability in pathogenicity of isolates of BYMV, PCMV, and RCVMV, and the relative effectiveness of mechanical and pea aphid transmission of BYMV and RCVMV.

**MATERIALS AND METHODS**

Sources and Care of Plant Material

Prior to Inoculation

Five varieties, 3 breeding lines, and 24 clones of red clover were tested. Varieties were 'Dollard' (Certified 37301), 'Lakeland' (Breeders), 'Pennscott' (Wisconsin common). Breeding lines were C-199 (isolates from stocks used to produce Lakeland), and C-201 (isolates of selected lines of Dollard). Sources and Maintenance of Virus Isolates

Five viruses were used. These were AMV, PCMV, RCVMV, and WPSV. Only 1 isolate of AMV was obtained by J. A. Milbrath from a potato (Solanum tuberosum L.) that was collected near Lexington, Kentucky by S. Diachun and BY-129, which was a virus-free selection from a field of Dollard. The other isolates of AMV were obtained by J. A. Milbrath from a potato (Solanum tuberosum L.) that was collected near Madison, Wisconsin. One isolate of PC-128, 2 isolates of RCVMV (RCV-1 and RCV-2), and 3 isolates of WPSV were used.

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