

sensitive as barley to the effects of BYDV infection. There are no examples of immunity or resistance to BYDV in wheat, although the North American bread-wheat cultivar Anza and several CIMMYT (International Maize and Wheat Improvement Centre, Mexico) bread-wheats show partial resistance to infection with BYDV. Most United Kingdom varieties are susceptible to infection, although the degree of susceptibility varies considerably.

New sources of resistance have been identified in a wide range of Triticeae accessions, in particular the genera *Hordeum*, *Leymus*, *Elymus*, and *Elytrigia* (22,23); and attempts are also being made to introduce the major gene *Yd2* from barley into a wheat background (24).

A transgenic approach to the control of BYDV in UK cereals would have to compete with current chemical control, which is both cheap and effective, but would have clear environmental advantages. Wheat would appear to represent a better candidate for transformation for virus resistance than barley because of the lack of suitable major gene resistance in the former.

#### 4.2. Potato Viruses

The most important viruses of potato are potato leaf roll virus (PLRV), potato virus Y (PVY), and potato virus X (PVX). There are several known sources of resistance to these viruses among the cultivated and wild potato species, and breeders have incorporated many of them into new potato crops.

PVX and PVY can be controlled by dominant genes conferring either hypersensitivity ( $N_x$ ,  $N_y$ ) or extreme resistance ( $R_x$ ,  $R_y$ ). The provenance of these genes is well-characterized (25), although genes from some sources are more effective than others. They are relatively easy to transfer to new varieties in breeding programs, since they are monogenic, and selection for resistance to PVX and PVY can be achieved via mechanical techniques. In contrast, breeding for PLRV resistance has met with only limited success due to complex genetic control and also by the difficulty in screening, since PLRV is transmitted by aphids. Sources of partial resistance include *S. acaule*, *S. demissum*, *S. chacoense*, and *S. tuberosum* subsp *andigena*. Some selections of *S. brevidans* are reported as having extreme resistance to PLRV, but the resistance is again most likely to be oligogenically controlled (26).

Overall, approx 40% of potato varieties on the NIAB 1995 recommended list have good resistance to either PVX or PVY. However, combining resistance into any one particular cultivar has proved difficult, and only one variety (Sante) on the current list has good resistance to all three major viruses. The potato industry displays very slow uptake of new varieties and so the varieties grown most widely are often susceptible to virus infection. However, this is not necessarily problematic in countries with good virus-free seed-growing areas and certification schemes. Transgenic approaches for improving potato