Relative Incidences of Beet Yellows and Beet Western Yellows Viruses in the Salt River Valley of Arizona, 1965-1968

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Visual symptoms in the field usually are inadequate criteria for distinguishing between sugarbeets infected with the beet yellows virus (BYV) and beet western yellows virus (BWYV). Therefore, concurrent with monthly disease surveys (6)[2], samples collected from yellowed plants were indexed in the greenhouse to determine the identity, relative incidences, and epidemiology of the two viruses in central Arizona. This study was begun 1 year before the first commercial acreage of beets was grown for sugar and was extended through two commercial campaigns.

Methods

Leaves from sugarbeets with typical virus yellows symptoms were collected monthly from widely scattered fields throughout central Arizona. The samples were washed thoroughly and placed in flasks of water in separate insect-proof cages. Aviruliferous green peach aphids [*Myzus persicae* (Sulz.)] were allowed to feed on the diseased leaves for about 24 hours and then transferred (10 or more per plant) to healthy seedlings of *Capsella bursa-pastoris* (L.) Medic., *Chenopodium capitatum* (L.) Asch., *Beta vulgaris* L. 'S 301-H' (sugarbeet), and *Sonchus oleraceus* L. The technique was essentially the same as described by Duffus (4). BYV induces distinctive symptoms in *C. capitatum* but does not infect *C. bursa-pastoris,* whereas BWYV induces symptoms in *C. bursa-pastoris* but not in *C. capitatum* (1, 3). *S. oleraceus* was included to detect the beet yellow stunt virus. The latter virus induces symptoms in *C. capitatum* that are milder but similar to those induced by BYV (Duffus, personal communication). This virus was not encountered throughout this study. After aphids had fed for 48 hours, they were killed with an aphicide and the plants were placed on the greenhouse bench for observations. Periodic sprays with insecticide and frequent fumigations

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[2] Numbers in parentheses refer to literature cited.

of the greenhouse prevented contaminations from stray aphids. A total of 724 samples were indexed between December 1965 and June 1968.

Results

The results of the indexings (Figure 1) indicated that beet western yellows was the most prevalent yellows disease in central Arizona from 1965 to 1968, inclusive. In 3 years, BYV was not detected until April or May and only in mixed infections with BWYV. Although the overall recovery of BYV was low as a percentage of total samples, in 1966, 1967, and 1968 the virus was recovered from 42%, 58%, and 27% of the June samples, respectively. Thus, once the virus was introduced into the beet fields, secondary spread occurred quite rapidly.

Discussion

The prevalence of BWYV over BYV in the Salt River Valley agreed with an earlier study by Coudriet (2). However, he recovered BYV in November, whereas I first detected the virus in late spring. Nevertheless, Coudriet obtained the greatest percentage of BYV-infected plants in April. Apparently, BWYV is more prevalent than BYV in other sugarbeet areas in western United States (5).

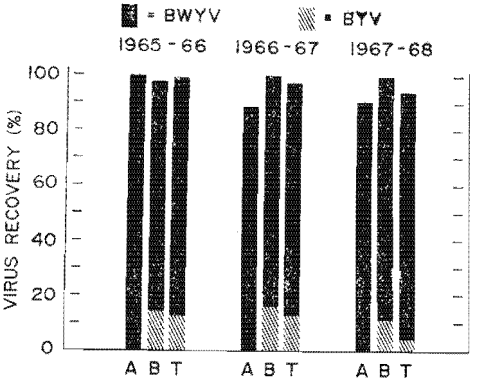

Figure 1.—Percentage recovery of beet yellows virus (BYV) and beet western yellows virus (BWYV) from field sugarbeets showing foliage yellowing in central Arizona from November through June 1965-66, 1966-67, and 1967-68; A, indexes made from November through February, B, indexes made from March through June, and T, total results.

The late detection of BYV might be explained in two ways. First, if a low percentage of incoming aphids were carrying the virus, the few plants that subsequently would have become infected might have escaped the monthly samples. Then, as second-

ary spread occurred there would have been a greater probability that BYV-infected plants were included in the indexes. Bennett (1) indicated that the perennial Australian saltbush (*Atriplex semibaccata* R. Br.) might be the source of BYV inoculum in Arizona. This species is a host of BYV, but only rarely does one find alate green peach aphids on these plants. Nevertheless, the relatively few aphids that begin to feed on diseased saltbush could acquire the virus and carry it to the beet fields. It also is conceivable that the primary inoculum (reservoir hosts) of BYV were located some distance from the commercial sugarbeet areas. BYV is non-persistent in the aphids. That is, most aphids lose their ability to transmit the virus within 24 to 48 hours after acquisition (1). Thus, the aphids would have to establish a succession of BYV-infected host plants until they were in close proximity to the beet fields. Such a succession of infected plants would take time and could account for the tardy occurrence of BYV in the spring (2).

BWYV and BYV are capable of inducing serious losses in sugarbeets; losses induced by simultaneous infection with both viruses are additive (5). The widespread distribution and prevalence of BWYV in Arizona, the large host range of the virus (3, 5), and the virus-vector relationships of BWYV (3) make control exceedingly difficult. However, if measures can be taken to prevent widespread and early occurrence of BYV in commercial beet fields, disastrous additive losses could be avoided. Since the beet itself apparently is the chief reservoir host of BYV, the maintenance of a beet-free period between the harvest of one beet crop and the planting of a succeeding beet crop is strongly recommended (1). Destruction of escaped beets, beets that resprout after harvest operations, and perhaps, saltbush also should reduce reservoirs of primary inoculum.

Literature Cited

(1) BENNETT, C. W. 1960. Sugar beet yellows disease in the United States. U.S. Dept. Agr. Tech. Bull. 1218, 63 p.

(2) COUDRIET, D. L. 1964. Migrant green peach aphids and the spread of yellows viruses in seed beet fields of Arizona. J. Econ. Ent. 57: 939-940.

(3) DUFFUS, J. E. 1960. Radish yellows, a disease of radish, sugar beet, and other crops. Phytopathology 50: 389-394.

(4) DUFFUS, J. E. 1961. Economic significance of beet western yellows (radish yellows) on sugar beet. Phytopathology 51: 605-607.

(5) DUFFUS, J. E. 1964. Host relationships of beet western yellows virus strains. Phytopathology 54: 736-738.

(6) RUPPEL, E. G., and R. J. BIRD. 1969. Sugar beet virus diseases in Arizona, 1965-1968. J. Am. Soc. Sugar Beet Technol. 15 (5) : 450-453.