A Severe Outbreak of Potato Virus Y in Chilean Tobacco

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ABSTRACT

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Potato virus Y was identified as the causal agent of the *necrosis severa* that has severely affected tobacco production in the Aconcagua Valley of Chile the past three growing seasons. The disease is widely spread in the valley except in areas where no other susceptible crops are cultivated. An average yield reduction of 34% due to *necrosis severa* in 1979–1980 was estimated from data for 73 fields totaling 274.8 ha. Highly affected plantings showed a 57.9% loss; those with a low incidence of *necrosis severa* had 13.4% yield reduction. Because of the symptomatology, we suspect that mild nonnecrotic and necrotic strains of potato virus Y were involved.

Virus diseases have become one of the major constraints for tobacco production in the Aconcagua Valley where about one-third of the Chilean tobacco crop is produced. *Necrosis severa* was associated with potato virus Y (PVY) in preliminary field surveys, although other virus diseases have been identified (5,6). Severe outbreaks of *necrosis severa* in 1978–1980 significantly reduced quantity and quality of yield. The disease also occurred in 1980–1981, but the incidence was lower than in previous years.

Plants with *necrosis severa* developed symptoms about 30 days after transplanting. Initial symptoms were vein clearing and banding, and chlorotic mottling on the expanding leaves. Vein necrosis, leaf malformation, and stunting appeared as the disease progressed. Severe vein necrosis that often extended into the midribs at the base of the lamina occurred on some diseased plants. Necrosis also appeared on the main stems. Leaves became prematurely yellow and rolled inward, and eventually the whole plant died. Severely affected plants had no commercial value.

We report results of field surveys to estimate the economic significance and geographic distribution of *necrosis severa* in the Aconcagua Valley, Chile.

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MATERIALS AND METHODS

Yield losses and geographic distribution of *necrosis severa* were determined from 73 different plantings of *Nicotiana tabacum* L. 'Coker 86' at the Compañía Chilena de Tabacos in the 1979–1980 growing season. Each field was classified as healthy or by incidence as low (1–30% diseased plants), medium (31–60% diseased plants), or high (61–100% diseased plants). All plantings received similar cultural practices; yield differences were presumed to be due to the incidence of *necrosis severa*.

In 1980–1981, 108 leaf samples were collected at random from individual plants in six tobacco fields in the Aconcagua Valley, and another 58

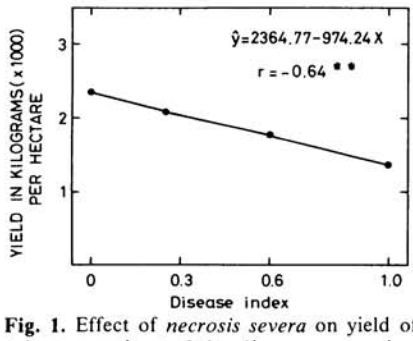

Fig. 1. Effect of *necrosis severa* on yield of tobacco estimated by linear regression analysis. Disease index: 0 = healthy, 0.3 = low (1–30% diseased plants), 0.6 = medium (31–60% diseased plants), 1.0 = high (61–100% diseased plants).

samples were obtained from four plantings in the Central Valley. Each sample was dried and stored in small vials containing silica gel. All samples collected in 1980 were from Coker 86; in 1981, 29 were from Coker 347, 11 were from Coker 86, and 1 was from NC-744. Leaves from each sample were triturated with potassium phosphate buffer 0.05 M, pH 7.0 (1 g/ml), filtered through cheesecloth, and rubbed onto *N. tabacum* 'Burley 21' and 'Coker 86,' *Datura stramonium, Cucumis sativus* 'National Pickling,' *Vicia faba,* and *Gomphrena globosa.*

Extracts from experimentally infected *N. tabacum* were tested against antisera to PVY, potato virus X (PVX), and cucumber mosaic virus (CMV) by the agar-gel double diffusion technique for tobacco viruses (1). Agar gels were absorbed with healthy tobacco leaf extract for 24–48 hr before use for CMV identifications.

RESULTS

Yield losses and geographic distribution. There was a negative correlation between the percent of infected plants and yield (Fig. 1). The correlation coefficient was −0.64, significant at $P = 0.01$.

Of 73 tobacco plantings, 26 (36%) were considered healthy, and 16 (22%), 12 (16%), and 19 (26%) of the fields had a low, medium, or high disease incidence, respectively. Average yield for healthy fields was 2,512.3 kg/ha, compared with 2,175.9, 1,976.8, and 1,057.0 for plantings with a low, medium, or high incidence of the disease (Table 1). Yield losses were highest in three different plantings where an average of 765 kg/ha was harvested from 13.7 ha, a 69.5 or 76.9% yield loss compared with the average from healthy fields or the highest yield (3,319 kg/ha), respectively, in the same season.

Necrosis severa was widespread in the Aconcagua Valley (Fig. 2), but it was rarely found in isolated areas surrounded by hills and natural vegetation.

Assays. Systemic infection was found in 76 of 166 tobacco leaf samples tested. Symptoms appeared about 15 days after inoculation as vein clearing, chlorotic mottling, and vein necrosis (Fig. 3), followed by chlorosis, leaf malformation, and dwarfing. Necrotic lesions on midribs extending into the main stems were also observed in about half of the samples. Three samples induced local lesions on *V. faba*, and three samples induced systemic infection in *C. sativus* and *D. stramonium*. No symptoms were produced on *G. globosa* with any sample.

PVY was detected serologically in all tobacco plants that reacted systemically after inoculation with the 76 field samples. CMV was identified in one of three samples that induced a systemic infection in *C. sativus*, and PVX was detected in one tobacco sample although no symptoms were obtained on *G. globosa*, a relatively specific indicator host for PVX (7).

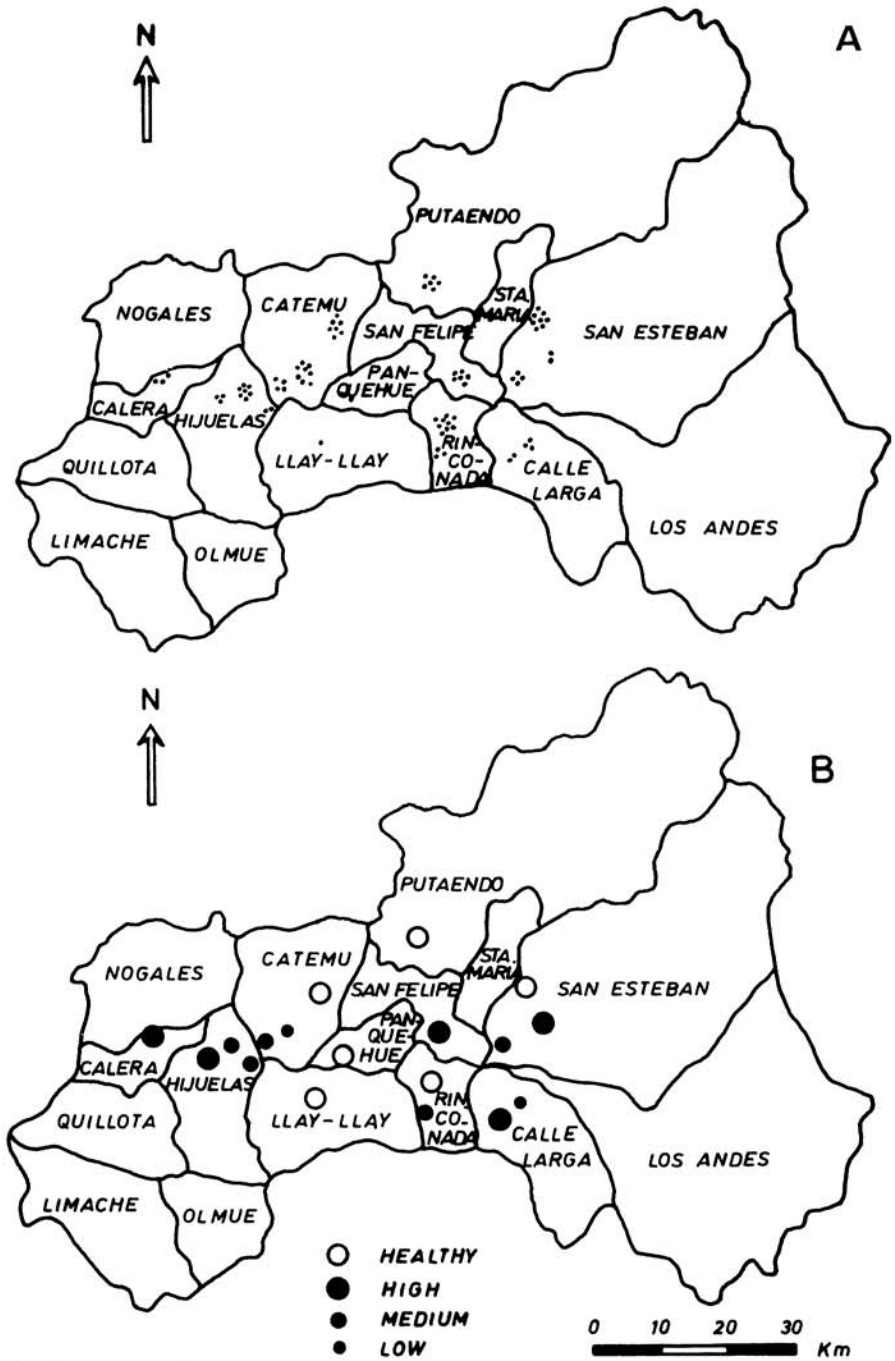

Fig. 2. Aconcagua Valley of Chile: **(A)** Tobacco production areas (each point represents 3.5 ha). **(B)** Incidence of *necrosis severa* in 1979–1980 (healthy = 0, high = 61–100%, medium = 31–60%, and low = 1–30% diseased plants).

DISCUSSION

These results corroborate previous reports that associated PVY with the *necrosis severa* of tobacco in Chile (5,6). The disease is widely spread in the Aconcagua Valley, and it has appeared in commercial fields in the Central Valley where about 60% of the tobacco is cultivated. The distribution and incidence of the disease may be related to the presence of other susceptible crops and weeds that act as virus reservoirs or overwintering hosts for insect vectors (2).

Mild, nonnecrotic and necrotic strains

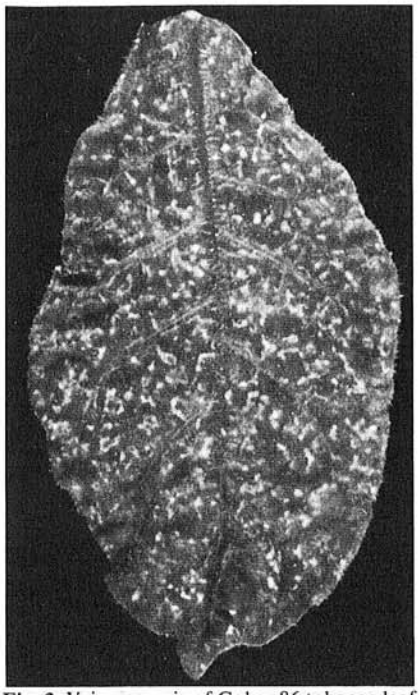

Fig. 3. Vein necrosis of Coker 86 tobacco leaf 15 days after inoculation with potato virus Y.

of PVY occur in Chile, but the proportion of the two types in the population has not been determined. The necrotic strain induces necrotic lesions on leaf midribs and stems, usually extending into the pith of the affected plants, and it appears to be similar to other aggressive strains (3,4).

Table 1. Yield losses attributed to *necrosis severa* associated with potato virus Y in Chilean tobacco plantings in 1979–1980

Field categories	Disease incidence (%)	No. of fields	Total size (ha)	Average yield (kg/ha)	Yield reduction (%)
Healthy	0	26	102.3	2,512.3	...
Diseased					
Low	0–30	16	59.9	2,175.9	13.4
Medium	31–60	12	38.9	1,976.8	21.3
High	61–100	19	73.7	1,057.0	57.9

The outbreak of *necrosis severa* in 1979–1980 had great economical impact, and disease incidence was far higher than that reported in other countries (5–7). Assuming an expected yield average in the Aconcagua Valley of 2,512.3 kg/ha, 433,371.7 kg of tobacco should have been harvested from 172.5 ha, but only 286,140 kg was harvested from diseased plantings. This represents a yield loss of 147,231.7 kg (34%), which was equivalent to approximately $264,255. Consequently, *necrosis severa* should be considered one of the most threatening and limiting factors to tobacco production in Chile.

Additional research is needed to clarify the significance of CMV and PVX in tobacco in Chile.

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