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Control of Carnation Streak Virus by Shoot-Tip Culture

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Virus concentration in a carnation plant is lowered or eliminated by growing small portions of the stem tip (1, 5, 6, 7, 9, 11). The techniques employed commonly include some period of heat treatment prior to removing the shoot tip. In addition, heat treatment alone has been found effective in controlling carnation virus diseases (2, 4, 10). The following experiment was conducted over a 3-year period to study the effect of shoot-tip culture on the carnation streak disease, and to determine the effects of streak virus on the growth of carnation plants.

Methods and Materials

Three varieties naturally infected with carnation streak virus were selected; Shibuya's Pink, Light Pink Littlefield and Orchid Beauty. Shoot tips 1 mm long were removed from these plants. No heat treatment was utilized and the cuttings selected showed definite streak symptoms. The shoot tips were placed in sterile test tubes containing a nutrient media (8). The growing tips were removed from the tubes and transplanted to pots containing volcanic scoria and grown to maturity. These plants were observed for symptoms of carnation streak for 2 years in the case of the Shibuya's Pink and 1 year for Orchid Beauty and Light Pink Littlefield. Cuttings were propagated from these plants, observed for streak symptoms, and compared to plants not derived from shoot-tip culture.

Results

Two-thirds of the shoot-tip plants did not show streak symptoms. Several plants developed indistinct symptoms in 6 months, which later proved to be streak. No symptoms of streak were noted in progeny grown from shoot tips derived from the variety Shibuya's Pink. These plants, and cuttings derived from these plants, were observed over a period of 2 years. Seventy cuttings from shoot-tip derived plants of the varieties Orchid Beauty and Light Pink Littlefield were grown for 5 months with cuttings derived from non-shoot-tip plants. These 70 plants represented 6 shoot-tip clones of each variety. The non-shoot-tip control cuttings naturally infected with streak virus had no symptoms of streak at the time of striking. The presence of streak symptoms was recorded after the plants had been grown for 20 weeks (December through April) at 70°F day temperature and 60° night temperature. No streak symptoms developed in 2/3 of the clones derived from shoot tips, while symptoms of streak appeared on all control plants (Table 1).

Table 1.--Control of carnation streak virus by shoot-tip culture

Variety	Clone	Number of plants grown from clones	Percent of plants with symptoms[a/]
Orchid Beauty	tip 1	8	0
	tip 2	12	0
	tip 4	6	100
	tip 6	4	0
	tip 7	4	100
	tip 11	3	0
	Control	18	100
Light Pink Littlefield	tip 1	8	100
	tip 3	8	0
	tip 4	4	0
	tip 6	4	0
	tip 7	4	50
	tip 8	8	0
	Control	20	100

a/ Symptoms were recorded after the plants had been grown for 20 weeks at 70°F day temperature and 60°F night temperature.

The fresh and oven dry weights of the plants in this 5-month experiment were recorded. These results, shown in Fig. 1, indicate the fresh weight of Orchid Beauty increased 43% when streak symptoms were absent, compared to control plants. Light Pink Littlefield increased 24%. The dry weights increased with the fresh weight, but not proportionately. This is shown more clearly by Fig. 2, where the percent of dry matter in these plants is graphed. There was a small increase in the percent of dry matter which correlated with the use of the shoot-tip technique rather than with the presence of streak symptoms.

Discussion

The paper supports previous work (1, 5, 6, 7, 9, 11) that shoot-tip culture is an effective method of reducing virus in carnation plants. Carnation streak virus may be effectively controlled by this treatment, when utilized along with careful roguing.

The effect of streak virus is severe and is evidenced by necrotic symptoms and a general lack of growth. The percent dry matter in plants appears to be increased as a result of the shoot-tip technique. This trend has been observed in varieties not containing streak virus (8). It would appear that a second virus or viruses may be influencing the dry matter in these plants.

Current flowering tests are evaluating clones that are free of streak symptoms. Records thus far indicate the first flower crop is not greatly influenced. An increase is anticipated for the second crop, especially for the variety Orchid Beauty.

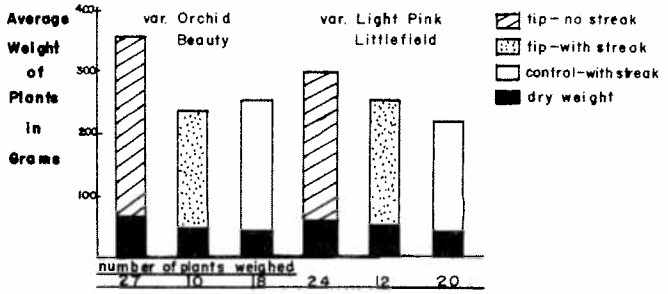

Fig. 1. Effect of streak virus on the weight of carnation plants.

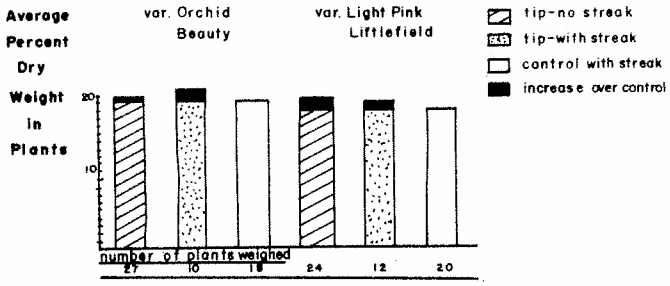

Fig. 2. Effect of the shoot-tip technique on dry matter in carnation plants.

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