Table 1. Distribution of fruitful (+), unfruitful (–), and dormant (o) buds at 7 defoliated or defoliated plus etiolated nodes[z], compared to the control[y].

Node no.	Defoliated 1975 +	Defoliated 1975 –	Defoliated 1975 o	Defoliated 1976 +	Defoliated 1976 –	Defoliated 1976 o	Etiolated 1976 +	Etiolated 1976 –	Etiolated 1976 o	Control 1976 +	Control 1976 –	Control 1976 o
1	5	3	7	8	0	11	6	0	11	4	0	1
2	8	2	5	13	0	6	7	0	10	5	0	0
3	7	4	5	12	0	7	6	1	10	4	0	1
4	10	1	4	16	1	1	10	0	7	4	0	1
5	13	0	2	13	1	3	8	0	9	4	0	1
6	12	1	2	15	0	2	10	0	7	2	0	5
7	8	0	7	15	1	3	9	1	7	3	0	1
% +[x]	85			97			96			100		
% o[w]			25			26			51			23

[z]Young leaves were removed from shoot apex. Etiolation was accomplished by wrapping the shoot portion with aluminum foil. (1 = distal, 7 = proximal node).

[y]Mature fully expanded leaves were removed.

[x]Based on buds which grew the following spring.

[w]Based on total no. of buds, including those which grew immediately following defoliation or that differentiated catkins.

Fig. 3. Shoots bearing nuts (within rings) arising from portion of 1-year-old wood (between arrows) which was defoliated and etiolated the previous summer.

nance was inhibiting budbreak, these buds began to differentiate floral parts and eventually became fruitful. Since the partially defoliated shoots resumed growth after a short lag period following defoliation, it is not certain whether the flower initiating substances originated from leaves above or below the defoliated zone. Nodes 1 to 3 defoliated in 1975 were less fruitful than nodes 4 to 7 but this trend did not hold for similarly treated shoots in 1976. More buds kept under foil failed to grow compared to those exposed (Table 1). Subsequently, these dormant buds and weak shoots from both treatments abscised. While the percentage of dormant buds on control shoots was nearly equal to the percentage on shoots where young leaves were removed, none abscised. Hence, the age of the buds when the leaves were removed and light exposure had a distinct effect on bud vitality. These findings reinforce our idea that some judicious annual dormant pruning to encourage second flush growth may be advantageous on these fruitful cultivars.

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HortScience 14(1):54–55. 1979.

Susceptibility of 25 Citrus Rootstocks to the Citrus Nematode[1]

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Additional index words. Tylenchulus semipenetrans

Abstract. **No significant difference in root or top weight of 25 citrus rootstock seedlings grown in the greenhouse for 15 months was attributable to infestation of the citrus nematode, *Tylenchulus semipenetrans* (Cobb). Many nematodes were found on the roots of most of the cultivars tested regardless of nematode biotype, with the exception of trifoliate orange and some hybrids where one parent was trifoliate orange.**

The citrus nematode exists in all citrus-growing areas of the world and in some instances can be one of the limiting factors in fruit production (9). Baines et al. (1) and Du Charme (8) found that all common species of citrus were susceptible to *T. semipenetrans* but that trifoliate orange (*Poncirus trifoliata* (L.) Raf.) possessed a high degree of resistance. Cameron et al. (6, 7) explored the possibility of hybridizing citrus species with trifoliate orange to produce nematode-resistant hybrids which could be used as rootstocks for citrus. Several such hybrids produced progeny which showed a reduction in infestation of *T. semipenetrans* when compared to citrus rootstocks now in use. Baines et al. (3) reported the existence of 4 biotypes of *T. semipenetrans* that differed from one another in their host preference for different citrus species.

Bitters et al. (4, 5) carried out long-term screening trials to find citrus rootstocks tolerant to tristeza virus.

[1]Received for publication June 26, 1978.
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Table 1. Infestation of citrus nematode, *T. semipenetrans*, on the roots of citrus rootstock seedlings.

Nematode count–Biotype 1 Selection	Mean		Nematode count–Biotype 2 Selection	Mean		Nematode count–Biotype 3 Selection	Mean	
Khasi papeda	6708	A[z]	Khasi papeda	3117	A[z]	Koejime	3345	A[z]
Alemow	355	B	C-32 citrange	2297	AB	Khasi papeda	3333	A
Miaray	3410	BC	Carrizo citrange	2209	ABC	Tosu	3276	A
Kikudaidai	3178	BCD	Estes rough lemon	1880	ABCD	Carrizo citrange	3252	A
Estes rough lemon	3157	BCD	Troyer citrange	1726	ABCD	Rangpur lime	2158	AB
Rangpur lime	2556	BCDE	Alemow	1407	BCDE	Troyer citrange	2146	AB
Yuma Ponderosa lemon	2476	BCDE	Yama Ponderosa lemon	1214	BCDE	Nasnaran	2079	AB
Konejime	1987	BCDEF	Kikudaidai	1202	BCDE	India lemon	2032	AB
Nasnaran	1906	BCDEF	Hanaju	1050	BCDE	Kikudaidai	1740	ABC
Carrizo citrange	1888	BCDEF	Konejime	951	CDE	Miaray	1706	ABCD
Tosu	1884	BCDEF	Rangpur lime	924	CDEF	Yuma Ponderosa lemon	1599	BCD
Troyer citrange	1802	CDEF	Miaray	907	DEF	Limoneira rough lemon	1447	BCDE
Shunkokan	1672	DEF	Tousu	864	DEF	C-32 citrange	1993	BCDE
C-32 citrange	1472	EF	Nasnaran	861	DEF	Alemow	1232	BCDE
H-56 tangor	1209	EFG	Limoneira rough lemon	774	DEF	H-56 tangor	1188	BCDE
Hanaju	1188	EFG	Kinkoje	689	DEF	Estes rough lemon	1157	BCDE
Limoneira rough lemon	1138	EFG	India lemon	592	EF	Hanaju	1124	BCDE
Kinkoje	912	FG	Argentine sweet orange	588	EF	Kinkoje	1027	BCDE
India lemon	839	FG	Cleopatra mandarin	477	EFG	Cleopatra mandarin	745	CDEF
Argentine sweet orange	775	FG	H-56 tangor	433	EFG	Argentine sweet orange	601	DEF
Cleopatra mandarin	447	G	Shunkokan	186	FGH	Shunkokan	520	EFG
C-35 citrange	2	H	Rubidoux trif. orange	50	GH	Rubidoux trif. orange	139	FGH
Swingle citrumelo sdlg.	<1	H	C-35 citrange	10	H	C-35 citrange	60	GH
Pomeroy trif. orange	<1	H	Swingle citrumelo sdlg.	<1	H	Pomeroy trif. orange	3	H
Rubidoux trif. orange	<1	H	Pomeroy trif. orange	<1	H	Swingle citrumelo sdlg.	<1	H

[z]Mean separation in columns by Duncan's multiple range test, 1% level.

It would also be of benefit if citrus rootstocks were resistant to citrus nematode and to various root rot-causing organisms. Rootstocks that have shown tolerance to tristeza, or might be useful as rootstocks for lemons although susceptible to tristeza when budded to other species of citrus, were tested for their tolerance to 3 biotypes of *T. semipenetrans*.

Seeds of the rootstocks to be tested were planted in heated germination beds early in the spring. Plants were transplanted to 3.8 liter (1 gallon) containers when they had grown to sufficient size, and moved into a greenhouse where the temperature was held at 29.4°C (80°F). Each rootstock was replicated 14 times in each treatment with each replicate consisting of a single plant. Seven replicates were inoculated with nematode eggs and larvae while 7 replicates served as uninoculated controls.

The soil around individual potted plants was inoculated in mid-November with biotypes 1, 2 and 3 (3) with a mixture totaling 8,000 nematode eggs and larvae per pot per biotype. The soil was reinoculated the following February with a mixture of 3,600 eggs and larvae of each biotype to increase the infestation. The proportion of eggs to larvae in the 2nd inoculation was biotype 1 = 55% eggs; biotype 2 = 53% eggs; and biotype 3 = 30% eggs.

Plant growth was vigorous. Some, such as the rough lemon types and Alemow, reached the top of the greenhouse. Others, such as Tosu, Hanaju, H-56 tangor and Nasnaran, were less vigorous. All plants were cut back in June to a height of 36 cm (14 inches) above the soil level and a record kept of the foliage removed. This pruning apparently had an adverse effect on subsequent root and top growth making plant and top weight so variable that only counts of female nematode infestation on roots were used as criteria for rootstock tolerance.

Plants were removed from the pots 1 year after the second inoculation, roots carefully washed, and root and weights recorded. Duplicate 2-g samples of feeder roots were taken from each plant and counts were made using Baines' technique (2).

Top and root weights of the plants and nematode counts from the feeder roots were compared using an analysis of variance and Duncan's multiple range test of mean differences.

Statistically significant differences were not found in top or root weights between inoculated plants and uninoculated controls of any of the 25 cultivars. This may have been caused in part by the pruning of excess vegetative growth part way through the experiment, or it may have been that the roots became potbound and growth was affected to the point where differences could not be expressed by plant weights. There were differences, however, in the number of nematodes infesting the feeder roots. Differences were statistically significant, but all of the true citrus cultivars and those of the citrus subgenus *Papeda* were infested to the point where none could be called nematode-tolerant. Cultivars and infestations according to nematode biotype are listed in Table 1.

One cultivar, Khasi papeda, had such a high nematode infestation, especially of biotype 1, that it was considered highly susceptible. Four of the rootstocks tested, Rubidoux and Pomeroy trifoliate orange, Swingle citrumelo seedling #4475 and C-35 citrange, were low enough in nematode infestation to be considered nematode-tolerant. In general, namatode infestation of each rootstock relative to each nematode biotype was similar with the exception of biotype 3 which was more pathogenic to trifoliate orange.

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