Resistance of Citrus Rootstocks to *Phytophthora citrophthora* During Winter Dormancy

Ö. TUZCU, Associate Professor, Department of Horticulture, University of Çukurova; A. ÇINAR, Professor, Department of Plant Protection, University of Çukurova; M. O. GÖKSEDEF, Research Plant Pathologist, Regional Plant Protection Institute; M. ÖZSAN, Professor, Department of Horticulture, University of Çukurova; and M. BİÇİCİ, Teaching Research Assistant, Department of Plant Protection, University of Çukurova, Adana, Turkey

ABSTRACT

Tuzcu, Ö., Çınar, A., Göksedef, M. O., Özsan, M., and Biçici, M. 1984. Resistance of citrus rootstocks to *Phytophthora citrophthora* during winter dormancy. Plant Disease 68:502-505.

Resistance of 70 citrus genera, species, and cultivars to *Phytophthora citrophthora* was investigated during winter dormancy. *Aeglopsis chevalieri; Citrus yatsushiro; C. sulcata; C. aurantium* 'Alibert' and 'Granito'; *C. reshni* 'Kıbrıs'; *Poncirus trifoliata* 'Yerli,' 'Jacobson,' 'SEAB,' 'Luisi,' 'Rubidoux,' 'Benecke,' 'Rich,' 'Ferme Blanche,' 'Troyer' citrange, and *C. ampullaceae* were found to be very resistant. *Citrus celebica; C. aurantium* 'Cardosi,' 'Santucci,' and 'Curaçao'; *C. pennivesiculata* 'CRC'; *C. depressa* 'CRC'; Carrizo citrange, *C. trifoliata* 'Menager'; *C. wilsonii*; and *C. webberi* 'SRA' were resistant. *C. keraji; C. nobilis; C. aurantium* 'Azaguie'; *C. trifoliata* 'Christian,' 'Town,' and 'Yamagushi'; *C. assamensis*; and *C. micrantha* were very susceptible. *C. aurantium* 'Yerli' showed medium resistance and 'Okan' was susceptible. Among the citrus rootstocks used widely, *C. taiwanica, C. macrophylla, C. aurantium* 'Brazilian,' and *C. junos* were ranked as susceptible to *P. citrophthora*.

There is a great potential for citrus culture in Turkey, where the citrus industry has been developing rapidly. Eighty-seven percent of the total citrus, and 93% of the lemons are produced near the Mediterranean Coast. Although the eastern Mediterranean area provides the most suitable growing conditions for lemon trees, its culture has been threatened by *Phytophthora*. It has been reported that 7.8% of lemon trees had trunk infections and 65% of the citrus orchard soils were contaminated by *Phytophthora* in Turkey (10,15). *P. citrophthora* (Sm. & Sm.) Leon., which incites gummosis or foot rot, is widely distributed in Mediterranean citrus areas (27). It was found that 24.0% of the citrus trees is İçel, and 22.4% in Adana provinces, based on fruit infection, were contaminated by *P. citrophthora* (12).

Use of resistant rootstocks offers an excellent means of reducing the damage caused by *P. citrophthora*. Resistant citrus species and varieties have been reported from many parts of the world. Although variations exist among the selections, trifoliate orange, sour orange, Cleopatra mandarin, Taiwanica, Citremon, Carrizo and Troyer citranges, Macrophylla, Siamelo, and Volkameriana were reported resistant (2,5,6,11,12,15–19, 21,23,25,26,28,30). Some sour oranges, mandarin, trifoliate oranges, oranges, Mexican lime, tangelo, and grapefruit were intermediate (1,3,6,10,11,17,20). Rough lemon, Rangpur lime, all citranges except Carrizo and Troyer, Madame Vinous orange, sweet lemon, and lemons were susceptible (6,7,10, 18,22,26).

Accepted for publication 16 December 1983.

The publication costs of this article were defrayed in part by page charge payment. This article must therefore be hereby marked "*advertisement*" in accordance with 18 U.S.C. § 1734 solely to indicate this fact.

Use of resistant rootstocks has provided partial success in preventing gummosis in Turkey. Lemons, although grafted on resistant sour orange stocks, show high incidence of infection in the eastern Mediterranean area. This paper reports a study of the relative resistance of various citrus rootstocks to root rot and canker caused by *P. citrophthora*.

MATERIALS AND METHODS

Two-year-old seedlings of 70 varieties and selections of citrus and related genera were used. These were obtained from various research institutes in the United States, France, Cyprus, and Turkey and are listed in Table 1.

Inoculum was prepared as follows: *P. citrophthora* was grown on 2% potato-dextrose agar at 26 C for 7 days, and disks 6, 8, and 10 mm in diameter were cut and transferred into 250-ml flasks containing sterilized distilled water. After being incubated for 24 hr at 18 C, the disks were

Table 1. The resistance of various varieties and selections of *Citrus* and related genera to *Phytophthora citrophthora*

Botanical name	Common name	Contributing institute[y]	Origin	Mean lesion index[z]
Aeglopsis chevalieri Swing.		IFAS	Florida	0.00 a
Citropsis gilletiana Swing. & M. Kell.		IFAS	Florida	0.00 a
Citrus yatsushiro Hort. ex Tan.		ATAE	Japan	0.00 a
C. sulcata Tak.		ATAE	Japan	0.00 a
C. aurantium L. 'Alibert'	Sour orange	SRA	Tunisia	0.00 a
C. reshni Hort. ex Tan. 'Kıbrıs'	Cyprus Cleopatra mandarin	Güzelyurt	Cyprus	0.00 a
Poncirus trifoliata (L.) Raf. 'Yerli'	Trifoliate orange	ÇÜZF	CRC	0.00 a
P. trifoliata 'Jacobson'	Trifoliate orange	SRA	CRC	0.00 a
P. trifoliata 'SEAB'	Trifoliate orange	SRA	Algeria (Boufarik)	0.00 a
P. trifoliata 'Luisi'	Trifoliate orange	SRA	France (Corsica)	0.00 a
P. trifoliata 'Rubidoux'	Trifoliate orange	ÇÜZF	CRC	0.00 a
P. trifoliata 'Benecke'	Trifoliate orange	ÇÜZF	CRC	0.01 a
C. sinensis Osb. × *P. trifoliata* 'Troyer'	Citrange	ÇÜZF	CRC	0.03 a
P. trifoliata 'Rich'	Trifoliate orange	SRA	CRC	0.06 ab
P. trifoliata 'Ferme Blanche'	Trifoliate orange	SRA	France (Perrégaux)	0.12 abc
C. ampullaceae Hort. ex Tan.		ATAE	Japan	0.14 abcd
C. aurantium 'Granito'	Sour orange	SRA	Algeria (Boufarik)	0.16 abcd
C. celebica Koord.		CRC	CRC	0.18 abcd
C. aurantium 'Santucci'	Sour orange	SRA	France (Corsica)	0.19 abcd
C. aurantium 'Cardosi'	Sour orange	SRA	CRC	0.21 abcd
C. pennivesiculata (Lush.) Tan. 'CRC'		SRA	CRC	0.21 abcd
C. depressa Hay. 'CRC'		CRC	CRC	0.23 abcdef

(*continued on next page*)

Table 1. *(continued from preceding page)*

Botanical name	Common name	Contributing institute[y]	Origin	Mean lesion index[z]
C. aurantium 'Curaçao'	Sour orange	SRA	CRC	0.24 abcdef
C. depressa 'Florida'		IFAS	Florida	0.25 abcdef
C. sinensis Osb. × *P. trifoliata* Raf. 'Carrizo'	Citrange	ÇÜZF	Turkey (Adana)	0.26 abcdef
C. jambhiri Lush.	Rough lemon	ÇÜZF	Turkey (Adana)	0.27 abcdefg
P. trifoliata 'Menager'	Trifoliate orange	SRA	France (Carcans)	0.29 abcdefgh
C. wilsonii Tan.	Ichang lemon	SRA	CRC	0.31 abcdefgh
C. webberi Wester 'SRA'	Kalpi papeda	SRA	CRC	0.31 abcdefgh
C. parasidi × *P. trifoliata* 'CRC 1452'	Citrumelo	ÇÜZF	CRC	0.32 abcdefghi
C. aurantium 'Vallauris'	Sour orange	SRA	France (Corsica)	0.34 abcdefghi
C. reshni Hort. Tan. 'Antalya'	Cleopatra mandarin	ATAE	CRC	0.34 abcdefghi
C. webberi 'CRC'	Kalpi papeda	SRA	CRC	0.35 abcdefghi
C. aurantium 'Genest'	Sour orange	SRA	Spain	0.38 abcdefghi
C. aurantium 'Yellow fruited'	Sour orange	Güzelyurt	Cyprus	0.39 abcdefghi
C. sinensis × *P. trifoliata* '8A-34/5'	Citrange	ÇÜZF	Turkey (Adana)	0.40 abcdefghi
C. aurantium 'Yerli'	Sour orange	ÇÜZF	Turkey (Adana)	0.45 abcdefghi
C. reshni 'SRA'	Cleopatra mandarin	SRA	CRC	0.47 abcdefghij
C. aurantium 'Tulear'	Sour orange	SRA	Madagascar	0.49 abcdefghij
C. taiwanica Tan. & Shim.	Taiwanica	ÇÜZF	CRC	0.54 abcdefghij
C. limon (L.) Burm. F. 'Borneo'	Citron	SRA	Morocco	0.54 abcdefghij
P. trifoliata 'Dwarf'	Trifoliate orange	SRA	CRC	0.54 abcdefghij
C. aurantium 'Australian'	Sour orange	SRA	CRC	0.54 abcdefghij
C. latipes (Swing.) Tan.		ÇÜZF	CRC	0.55 abcdefghij
C. aurantium 'Brazil'	Sour orange	SRA	Brazil	0.59 abcdefghij
C. aurantium 'Okan'	Sour orange	Uluçinar	Turkey (Hatay)	0.62 abcdefghij
C. aurantium 'Brazilian'	Sour orange	CRC	CRC	0.62 abcdefghij
C. macrophylla Wester	Macrophylla	ÇÜZF	CRC	0.66 abcdefghijk
C. madurensis Lour. 'CRC'	Calamondin	CRC	CRC	0.68 abcdefghijk
C. aurantium 'Red fruited'	Sour orange	Güzelyurt	Cyprus	0.69 abcdefghijk
C. mitis Blanco 'Antalya'	Calamondin	ATAE	CRC	0.74 abcdefghijkl
C. aurantium 'Luisi'	Sour orange	SRA	France (Corsica)	0.76 abcdefghijk
C. obovoidea Hort. ex Tak.		ATAE	Japan	0.77 abcdefghijk
C. tachibana (Mak.) Tan.		CRC	CRC	0.79 abcdefghijk
C. sinensis 'Madam Vinous'	Sweet orange	ATAE	CRC	0.84 bcdefghijkl
C. aurantium 'Ruche Fonciére'	Sour orange	SRA	France (Corsica)	0.84 bcdefghijkl
C. pennivesiculata 'SRA'		CRC	CRC	0.86 cdefghijkl
C. natsudaidai Hay.		ATAE	CRC	0.86 cdefghijkl
C. junos Sieb. ex Tan.	Yuzu	ÇÜZF	Turkey (Adana)	0.92 defghijkl
C. keraji Hort. ex Tan.		ATAE	Japan	1.01 efghijkl
C. volkameriana (Pasq.) Tan.	Volkameriana	ÇÜZF	CRC	1.02 fghijkl
C. limonia Osbeck	Rangpur lime	ÇÜZF	CRC	1.05 ghijkl
C. intermedia Hort. ex Tan.		CRC	CRC	1.08 hijkl
C. nobilis Lour.	King mandarin	ATAE	CRC	1.11 ijkl
C. aurantium 'Azaguié'	Sour orange	SRA	Ivory Coast	1.26 jklm
P. trifoliata 'Christian'	Trifoliate orange	SRA	CRC	1.42 klm
P. trifoliata 'Town'	Trifoliate orange	SRA	CRC	1.44 klm
C. assamensis Dutta & Bhatt.		CRC	CRC	1.63 lm
P. trifoliata 'Yamagushi'	Trifoliate orange	SRA	CRC	1.96 mn
C. micrantha Wester		CRC	CRC	2.73 n
D 0.01				0.79

[y] ATAE = Citrus Research Institute, Antalya, Turkey; CRC = Citrus Research Center, Riverside, CA; ÇÜZF = University of Çukurova, Faculty of Agriculture, Adana, Turkey; IFAS = Institute of Food and Agricultural Sciences, Gainesville, FL; and SRA = Citrus Research Institute, Corsica, France.

[z] Lesion index = $\sqrt{\text{lesion area (mm}^2)} \div$ stem diameter at lesion site (mm); means of 10 replicates per plant species or cultivar. Means followed by the same letter are not significantly different ($P = 0.01$) according to Tukey's procedure.

used as inoculum.

Disks of bark 6, 8, and 10 mm in diameter were cut with a cork borer 30–35 cm above the ground from the trunks of rootstocks. An inoculum disk of the same size was inserted mycelial face inward into each of the holes where cambium had been exposed and was covered with the disk of bark. The inoculation site was wrapped with cotton moistened with sterile water, then covered with aluminum foil and polyethylene. Inoculations were made on 19 November 1981 and the wrappings were removed on 25 November 1981. Ten plants of each type were inoculated. During the period of lesion development, the mean temperature was 13.5 C, with 9.5 C mean minimum and 23.1 C mean maximum.

Thirty-five days after inoculation, the inoculated rootstocks were cut 25–30 cm above and below the inoculation site and brought to laboratory. Infected bark was removed carefully and the lesion areas on the cambium were traced on translucent paper and measured with an Automatic Area Meter Type AAM-5. Stem diameter at the lesion site was also measured. During measurement, external appearance of the lesion site and gummosis under the bark were recorded. Results were evaluated after transforming the measurements to lesion index (I) according to Çınar and Tuzcu (11):

$$I = \frac{\sqrt{LA}}{D},$$

where LA = lesion area (mm^2) and D = mean diameter of the stem (mm). Differences among the lesion indices were tested statistically (13).

RESULTS AND DISCUSSION

The degree of resistance of each rootstock to *P. citrophthora* is indicated by its mean lesion index (Table 1). The degree of resistance varied greatly among the rootstocks during their dormancy. *Aeglopsis chevalieri, Citropsis gilletiana, Citrus yatsushiro, C. sulcata,* Alibert sour orange, Kıbrıs Cleopatra mandarin; Yerli, Jacobson, SEAB, Luisi, Rubidoux, and Benecke trifoliate oranges and Troyer citrange were highly resistant. Rich and Ferme Blanche trifoliate oranges, *C. ampullaceae*, and Granito sour orange also showed resistance to the pathogen. These results are in agreement with results obtained by Carpenter and Furr (8), Klotz (20), and Laville and Blondel (24). Although they are wound-resistant, *A. chevalieri* and *Citropsis gilletiana* cannot be recommended to the growers at this stage because of their incompatibility with citrus varieties compared with other citrus rootstocks (1). However, these two species might be chosen as parent lines for hybridization to obtain resistant rootstocks.

C. yatsushiro, C. sulcata, and *C. ampullaceae* are considered different species by Tanaka, but in Swingle's system, *C. yatsushiro* is placed in mandarin and *C. sulcata* and *C. ampullaceae* are placed in grapefruit. Because of their Far Eastern origin and their nonacceptance as separate species under Swingle's taxonomic system, very limited studies have been made on the resistance of these rootstocks to *P. citrophthora.* Detailed studies on the rootstock characters and resistance of these three species may reveal useful traits. The high resistance of *C. yatsushiro* in this study and its suitability as a rootstock for orange and mandarin make it a promising rootstock for these species. *C. sulcata* and *C. ampullaceae* also possess good possibilities as lemon rootstocks because they both showed resistant reactions to the pathogen and

grapefruit is known as the best rootstock for lemon (31). The varieties of some species did not differ from each other significantly (eg, *Citrus webberi* var. SRA and var. CRC [CRC and Antalya calamondin]), but sour orange and trifoliate orange rootstocks, which were evaluated separately (Table 2), showed varying reactions to the pathogen. Cleopatra mandarin and *C. pennivesiculata* also showed varying reactions.

Rootstocks were ranked as follows: those having lesion index values up to 0.15 highly resistant, those between 0.15 and 0.30 resistant, those between 0.30 and 0.50 intermediate, those between 0.50 and 1.00 susceptible, and those higher than 1.00 highly susceptible. In general, the rankings presented here are in agreement with those given by Carpenter and Furr (8), Frossard (14), Laville and Blondel (24), Grimm and Timmer (17), and Carpenter et al (7). However, some rootstocks showed different susceptibility than reported previously. Other workers have also reported conflicting information about clones or varieties of same species (4,5,18,32).

Although Taiwanica, Macrophylla, Yuzu, and Volkameriana have recently been accepted as promising rootstocks, they did not show resistance to winter infections of *P. citrophthora* (Table 1). The other interesting result was that Yamagushi, Town, and Christian trifoliate oranges and Azaguié sour orange and King mandarin were more susceptible than Rangpur lime. Some trifoliate orange selections have been reported as highly resistant and some selections of sour orange as resistant. The relative susceptibility of the trifoliates and some sour oranges obtained in this study may be due to different genetical makeup existing among the clones or varieties.

Although not investigated thoroughly, *Citrus latipes, C. obovoidea, C. tachibana, C. natsudaidai, C. intermedia, C. assamensis,* and *C. micrantha* were found susceptible and could not be recommended as rootstocks for Turkish conditions, except for specific purposes.

The susceptibility of sour oranges with different origins varied greatly (Table 2). Sour orange has been accepted as a resistant rootstock and used widely in Turkey without looking into varietal differences. Although two local sour oranges, Yerli and Okan, showed no statistical differences, they showed different susceptibility according to our ranking system. In general ranking, Yerli sour orange was intermediate and Okan was susceptible. Therefore, the susceptibility of the varieties and possible hybrids of sour orange to *P. citrophthora* should be investigated in detail. Among the sour oranges studied, Alibert was highly resistant and Granito, Santucci, and Curaçao were resistant. *C. taiwanica* was ranked as susceptible (Table 2). Azaguié sour orange was highly susceptible. This varying reaction of the sour oranges indicates the importance and necessity of studying the various properties of each variety or selection. An investigation of the reactions of 29 clones selected by Tuzcu (29) from the eastern Mediterranean area but not included in this study may reveal some highly resistant rootstocks and could be beneficial for Turkey's citrus culture.

As seen in Table 3, Yerli, Jacobson, SEAB, Luisi, Rubidoux, Benecke, Rich, and Ferme Blanche trifoliate oranges and Troyer citrange were highly resistant; Citrumelo CRC 1452 and citrange 8 A-34/5 were resistant. Dwarf trifoliate orange was susceptible, and Christian, Town, and Yamagushi trifoliate oranges were highly susceptible. These results are, in general, in accordance with Laville and Blondel (24); however, those authors reported SEAB and Ferme Blanche trifoliate oranges as susceptible. Carpenter and Furr (8) found that Rich and Benecke trifoliates were resistant. Although Yamagushi trifoliate orange was determined resistant by Hutchinson and Grimm (19) and Vanderweyen (30), it showed a susceptible reaction in this study (Table 3). Our results support the suggestion by various authors (4,9,18, 20,24) that resistance of rootstocks to *P. citrophthora* should be investigated at varietal or even clonal levels instead of species level. Otherwise, ranking the rootstocks at species level may create discrepancies. The reactions of Cleopatra mandarins with different origins provide an example (Table 4). Kıbrıs Cleopatra mandarin was highly resistant and Antalya and SRA Cleopatra mandarin were intermediate. Although Cleopatra mandarin was reported as intermediate in resistance by Blondel (3), it was found susceptible by Vanderweyen (30), Frossard (14), and Grimm and Timmer (17). Our results indicate that Kıbrıs Cleopatra mandarin could be ranked as highly resistant to *P. citrophthora* infections during dormancy.

Table 2. Resistance of various cultivars of *Citrus aurantium, C. taiwanica,* and *C. intermedia* to *Phytophthora citrophthora*

Species Cultivar	Source	Mean lesion index[z]
Citrus aurantium		
Alibert	Tunisia	0.0 a
Granito	Algeria	0.16 ab
Santucci	Corsica	0.19 ab
Cardoşi	Corsica	0.21 ab
Curaçao	South America	0.24 abc
Vallauris	France (Nice)	0.34 abcd
Genest	Spain	0.38 abcd
Yellow Fruited	Cyprus (Güzelyurt)	0.39 abcd
Yerli	Turkey (Adana)	0.45 abcd
Tulear	Madagascar	0.49 abcd
Australian	Australia	0.55 bcde
Brasil	Brazil	0.59 bcde
Okan	Turkey (Uluçınar)	0.62 bcde
Brazilian	Brazil	0.62 bcde
Red Fruited	Cyprus (Güzelyurt)	0.69 bcde
Luisi	Corsica	0.76 cdef
Ruche Foncière	Corsica	0.84 def
Azaguié	Ivory Coast	1.26 f
C. taiwanica	United States	0.54 abcde
C. intermedia	United States	1.08 ef
D 0.01		0.54

[z] Lesion index = $\sqrt{\text{lesion area (mm}^2\text{)}} \div$ stem diameter at lesion site (mm); means of 10 replicates per plant species or cultivar. Means followed by the same letter are not significantly different ($P = 0.01$) according to Tukey's procedure.

Table 3. Resistance of various trifoliate oranges and citranges and their hybrids to *Phytophthora citrophthora*

Species Cultivar	Source	Lesion index mean[z]
Poncirus trifoliata		
Yerli	Turkey (Rize)	0.00 a
Jacobson	United States	0.00 a
SEAB	Algeria	0.00 a
Luisi	Corsica	0.00 a
Rubidoux	United States	0.00 a
Benecke	United States	0.00 a
Troyer citrange	United States	0.03 a
Rich	United States	0.06 ab
Ferme Blanche	Algeria	0.12 ab
Carrizo citrange	United States	0.26 ab
Menager	France	0.29 abc
1452 citrumelo	United States	0.32 abc
8A-34/5 citrange	United States	0.40 bc
Dwarf	United States	0.54 c
Christian	South Africa	1.42 d
Town	United States	1.44 d
Yamagushi	United States	1.96 e
D 0.01		0.35

[z] Lesion index = $\sqrt{\text{lesion area (mm}^2\text{)}}$: stem diameter at lesion site (mm); means of 10 replicates per plant species or cultivar. Means followed by the same letter are not significantly different ($P = 0.01$) according to Tukey's procedure.

Table 4. Resistance of Cleopatra mandarin cultivars obtained from different sources to *Phytophthora citrophthora*

Species Cultivar	Source	Mean lesion index[z]
Citrus reshni		
Kıbrıs	Cyprus	0.00 a
Antalya	Antalya	0.34 b
SRA	Corsica	0.47 b
D 0.01		0.16

[z] Lesion index = $\sqrt{\text{lesion area (mm}^2\text{)}} \div$ stem diameter at lesion site (mm); means of 10 replicates per plant species or cultivar. Means followed by the same letter are not significantly different ($P = 0.01$) according to Tukey's procedure.

ACKNOWLEDGMENTS

We thank the Turkish Scientific and Technical Council (TUBITAK) for financial support and E. Şekeroğlu for his valuable assistance in preparation of the manuscript.

LITERATURE CITED

1. Bitters, W. P., Cole, D. A., and McCarty, C. D. 1977. Citrus relatives are not irrelevant as dwarf stocks or interstocks for citrus. Proc. Int. Soc. Citricult. 2:561-567.
2. Blondel, L. 1969. Research on citrus rootstocks in Corsica. Proc. Int. Citrus Symp. 1:367-371.

3. Blondel, L. 1973. Les porte-greffe des agrumes en Corse. Somivac. 68:41-48.
4. Boccas, B., and Laville, E. 1978. Les maladies à *Phytophthora* des agrumes. SETCO-IRRA, Paris. 162 pp.
5. Broadbent, P. 1973. Phytophthora disease of citrus. A review. Proc. Int. Soc. Citricult. 3:986-992.
6. Broadbent, P., Fraser, L. R., and Waterworth, Y. 1971. The reaction of seedlings of *Citrus* spp. and related genera to *Phytophthora citrophthora*. Proc. Linnean Soc. N.S.W. 9:219-227.
7. Carpenter, J. B., Burnis, R. M., and Sedlacek, R. F. 1981. Phytophthora resistant rootstocks for Lisbon lemons in California. Citrograph 66:287-288, 291-292.
8. Carpenter, J. B., and Furr, J. R. 1962. Evaluation of tolerance to root rot caused by *Phytophthora parasitica* in seedlings of citrus and related genera. Phytopathology 52:1277-1285.
9. Chapot, H. 1965. Maladies, troubles et ravageurs des agrumes au Maroc. INRA de Maroc. Rabat. 339 pp.
10. Çınar, A. 1976. İçel ve Adana Bölgesi turunçgil ağaçlarında *Phytophthora citrophthora* (Smith and Smith) Leonian zararı ve topraklarda hastalık potansiyel indeksinin araştırılması. Ç. Ü. Ziraat Fakültesi Yıllığı 5:117-125.
11. Çınar, A., and Tuzcu, Ö. 1976. Resistance study of the citrus rootstocks to *Phytophthora citrophthora* (Smith and Smith) Leonian. II. The use of new method in selecting resistance citrus rootstocks to *Phytophthora citrophthora* (Smith and Smith) Leonian. J. Turk. Phytopathol. 5:98-99.
12. Çınar, A., Tuzcu, Ö., and Göksedef, M. O. 1976. Resistance study of the citrus rootstocks to *Phytophthora citrophthora* (Smith and Smith) Leonian. I. Research on the resistance of 14 different citrus rootstocks to *Phytophthora citrophthora* (Smith and Smith) Leonian. J. Turk. Phytopathol. 5:49-59.
13. Düzgüneş, O. 1963. Bilimsel araştırmalarda istatistik prensipleri ve metotları. Ege Üniversitesi Matbaası. İzmir. 375 pp.
14. Frossard, R., 1978. Lutte contre la gommose des agrumes en Côte d'Ivoire. Fruits 33:889-891.
15. Göksedef, M. O. 1980. Akdeniz bölgesi limonlarında gövde zamklanma etmeni *Phytophthora citrophthora* (Smith and Smith) Leonian'ın yayılışı, bazı biyolojik özellikleri ve tarimsal savaş yöntemleri ile infeksiyon süresinde etmene karşi farklı duyarlık gösteren turunçgil çeşitlerindeki dayanıklılık nedenlerinin saptanması üzerinde araştırmalar (Yayanlanmamış) Doktorra Tezi. Adana. 101 pp.
16. Grimm, G. R., and Hutchinson, D. J. 1973. A procedure for evaluating resistance of citrus seedlings to *Phytophthora parasitica*. Plant Dis. Rep. 57:669-672.
17. Grimm, G. R., and Timmer, W. 1981. Control of Phytophthora foot rot and root rot. Citrus Ind. 62:34-39.
18. Hutchinson, D. C., and Cooper, W. C. 1977. Recent advances in the search for improved citrus rootstocks in Florida. I. Cong. Mundial Citricult. 2:181-184.
19. Hutchinson, D. J., and Grimm, G. R. 1973. Citrus clones resistant to *Phytophthora parasitica*: 1973 screening results. Proc. Fla. State Hortic. Soc. 86:88-91.
20. Klotz, L. J. 1978. Fungal, bacterial and nonparasitic diseases. Pages 1-66 in: Citrus Industry. Vol. 4. W. Reuther, E. C. Calavan, and G. E. Carman, eds. Univ. Calif., Div. Agric. Sci., Berkeley.
21. Klotz, L. J., Bitters, W. P., Dewolfe, T. A., and Garber, M. J. 1968. Some factors in resistance of *Citrus* to *Phytophthora* spp. Plant Dis. Rep. 52:952-955.
22. Klotz, L. J., and Calavan, E. C. 1969. Gum diseases of citrus in California. Calif. Agric. Exp. Stn. Circ. 369. 26 pp.
23. Klotz, L. J., Dewolfe, T. A., and Baines, R. C. 1969. Resistance of trifoliate orange stocks to gummosis. Citrograph 54:259-260.
24. Laville, E., and Blondel, L. 1979. Comportement de différents clones de *Poncirus trifoliata* aux attaques racinaires à *Phytophthora* sp. Fruits 34:175-178.
25. Newcomb, D. A. 1978. Rootstocks and nursery practice. Proc. Int. Soc. Citricult. 1:117-120.
26. Roth, G. 1966. The pathogenicity of *Diplodia natalensis* and *Phytophthora citrophthora* (Smith and Smith) Leon. to citrus rootstocks. Phytopathology 57:201-215.
27. Salih, N. 1974. Adana çevresinde turunçgillerde meyve ve kökboğazı çürüklüğü yapan *Phytophthora citrophthora* (Smith and Smith) Leonian'a yayılısı ve biyolojisi üzerinde araştırmalar. Adana Böl. Zir. Müc. Araşt. Enst. Yayın No. 35, Adana. 102 pp.
28. Schneider, H., Platt, R. C., Bitters, W. P. and Burns, R. M. 1978. Diseases and incompatibilities that cause decline in lemons. Citrograph 63:219-221.
29. Tuzcu, Ö., Özsan, M., and Kaplankiran, M. 1983. Doğu Akdeniz yerli turunçlarinin büyüme durumları. Pages 207-227 in: Tubitak-Toag 7. Bilim Kongresi (Bahçe Bitkileri Seksiyonu). Tubitak Yayın No. 547. Tübitak Matbaası, Ankara. 539 pp.
30. Vanderweyen, A. 1973. La gommose a *Phytophthora* des agrumes au Maroc. C. R. Acad. Agric. Fr. 59:125-129.
31. Webber, H. J. 1948. Rootstocks: Their character and reactions. Pages 69-168 in: Citrus Industry. Vol. 2. L. D. Batchelor and H. J. Webber, eds. University of California Press, Berkeley.
32. Whiteside, J. O. 1973. Phytophthora studies on citrus rootstocks. Proc. Int. Citrus Short Course, Univ. Fla.