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C O N T E N T S

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Nachweis der wurzelfäuleerreger an Linsen in der Umgebung von Ankara

Haluk SORAN

Lehrstuhl für Pflanzenpathologie, Landwirtschaftliche Fakultaet der Universitaet Ankara, TURKEI

ZUSAMMENFASSUNG

Um die Krankheiten an Linsen festzustellen, wurden im Jahre 1978 die Anbaugebiete in der Umgebung von Ankara untersucht. An allen Orten wurde die Wurzelfäule als wichtigste Krankheit beobachtet.

Aus den gesammelten erkrankten Pflanzen wurden **F. oxysporum, F. acuminatum, F. solani, F. redolens, R. solani** und **P. ultimum** isoliert. Bei den Pathogenitätstesten erwiesen sich die Isolate aus allen Arten in der geprüften Auswahl sämtlich als pathogen.

EINLEITUNG

Die Linse **(Lens culinaris)** ist eine von den altesten Kulturpflanzen Sie wird seit 4000 Jahren in der Turkei, hauptsächlich in Mittelanatolien und in den ähnlichen Trockenklimagebieten angebaut. In diesen Gebieten wird der Ertrag oft durch Fusskrankheiten begrenzt.

Auch in anderen Linsenanbaugebieten der Erde wie Indien, Ägypten und Iran werden diese Krankheiten als wichtigster Begrenzungsfaktör angesehen (2.4.7.10).

Ein Literaturüberblick lässt erkennen, dass sich je nach Umgebungsverhältnissen viele verschiede-

ne Erreger an der Krankheit beteiligen (3.5.15).

In der Türkei wurde zwar Wurzelfäule an Linsen festgestellt (8), jedoch bisher keine grundlegenden Untersuchungen darüber angestellt. Daher wird in dieser Arbeit versucht klarzustellen, welche Pilzarten bei der Krankheit beteiligt sind.

MATERIAL UND METHODEN

Um den Krankheitsverlauf zu beobachten und erkrankte Pflanzen zu sammeln, wurden in den Monaten Juni-August 1978 Linsenfelder in der Umgebung vin Ankara besucht. Dabei konnten von verschiedenen Gebieten Pflanzenproben entnommen und in Plastiktüten für Laboruntersuchungen mitgenommen, werden.

Die Wurzeln von erkranten Pflanzen wurden mit Leitungswasser gut gewaschen und in eine 40 ppm Aureo mycin-Lösung (3-5 min) eingetaucht. Nach mehrfachem weiteren Waschen mit sterilem Wasser wurden die nekrotischen Wurzelteile abgeschnitten und in Petrischalen auf Wasser-Agar (5 g. Agar, 100 ml Dest. Wasser) ausgelegt. Nach 48-stündiger Bebrütung bei 20°C folgte die Uberimpfung der ausgewachsenen Pilze auf PBA (0,25 g Pepton; 1,5 g Biomalz; 1,5 Agar 100 ml Dest. H_2O).

Die Vermehrung der zu testenden Pilze erfogte auf PBA in Petrischalen. Nachdem diese voll bewachsen waren, wurden Scheiben mit einem Durchmesser von 7 cm ausgeschnitten und in einen Blumentopf gelegt (8 cm), der zu 2/3 mit gedämpfter Komposterde (an 3 aufeinander folgenden Tagen je 1 Std. bei 110 °C) gefült war. Die Töpfe wurden mit einer 1 cm hohen Schicht der gleichen Komposterde bedeckt. Auf diese wurden pro Topf 5 desinfizierte Samen ausgelegt und mit weiteren 2 cm Komposterde bedeckt.

ERGEBNISSE

Die im Jahre 1978 in der Umgebung von Ankara durchgeführten Beobachtungen haben gezeigt, dass in allen Anbaugebieten Wurzelfäule schädlich und weitverbreitet ist.

Auf fast allen Linsenfeldern kann man kurz nach dem Auflaufen und auch später Pflanzen finden, die gelb

werden, umfallen und eingehen (Abb 1). Die nähere Untersuchung derartiger Pflanzen ergibt, dass Hauptwurzel und Stengelgrund braune Flecken zeigen (Abb. 2). Im späteren Stadium sieht man auf den Feldern einzelne vertrocknete Pflanzen.

Um die Wurzelfäuleerreger festzustellen, wurden aus mehreren Linsenfeldern in der Umgebung von Ankara erkrankte Pflanzen gesammelt und nach ihrem Pilzbesatz untersucht. Die Ergebnisse sind aus der Tabelle 1 zu ersehen.

Die meisten ausgelegten Wurzelfragmente liessen Pilze herauswachsen unter denen sich bestimmte. Arten besonders häufig befanden. Diese sind einzeln erfasst, der Rest jedoch in Gruppen. Am häufigsten traten Fusarium und Rhizoctonia - Arten auf. Unter ersteren liessen sich regelmässig 4 verschiedene Arten durch Unterschiede in der Wuchsform und der Gestalt der Konidien erkennen. Sie wurden getrennt erfasst und als **Fusarium oxysporum**, **Fusarium acuminatum**, **Fusarium solani** und **Fusarium redolens** bestimmt.

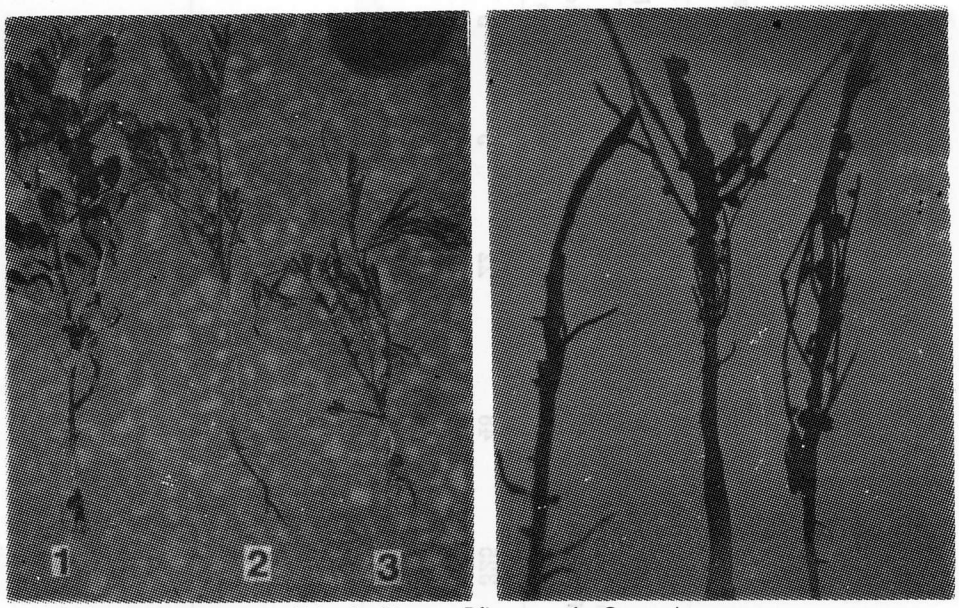

Abb. 1: Linsen Pflanzen. 1, Gesund
2,3, Erkrankt durch Wurzelfäule
Abb. 2: Die Wurzeln von erkrankten Pflanzen

Tabelle 1. Einfluss der Standorten auf die Pilzflora der Linsen

Felder in	Untersuchten Pflanzen-anzahl	Prozentuale Häufigkeit									
		F. oxysporum	F. acuminatum	F. Solani	F. redo-lens	Fusarium ins - gesamt	Rhizoc-tonia	Pythium	Andere Pilzar-ten	Nicht definierbre Pilzarten	Ohne Pilz-besatz
Çubuk	325	48	22	5	5	80	1	0	19	0	0
Kalecik	375	40	32	5	3	80	1	3	4	5	7
Ayaş	250	48	18	12	8	86	2	2	0	8	2
Beypazarı	150	41	13	13	3	70	30	0	0	0	0
Kızılcahamam	150	7	13	3	3	26	50	0	0	24	0
Polatlı	275	49	13	7	4	73	4	2	0	21	0
Haymana	125	80	8	0	0	88	8	0	4	0	0
Summe	1650	44	19	7	4	74	10	1	5	8	2

Regelmässig fanden sich an den erkrankten Wurzeln Rhizoctonia. Die Isolate waren einheitlich und erwiesen sich als **R. solani.**

Die Gattung Pythium wurde in geringem Prozentsatz aus den Wurzeln isoliert und als **Pythium ultimum** bestimmt.

Sämtliche Pilzgruppen waren auf allen Feldern mit geringer unterschiedlicher Häufigkeit zu finden. Eine Ausnahme Machten **F. solani, F. redolens** und **Pythium ultimum.** İn Haymana wurde kein **F. solani** und **F. redolens** vorgefunden. In Çubuk, Beypazarı, Kızılcahamam und Haymana wurde aus den Pflanzen kein **Pythium** isoliert.

Insgesamt wurden während unserer Versuche 1620 Pilzisolate aus kranken Pflanzen gewonnen, Aus 6, wahrscheinlich pathogenen Arten wurde jeweils eine grössere Anzahl von Isolaten ausgewählt und getestet (Tabb. 2). Die 10 Rhizoctonia und Pythium Isolate erwiesen sich alle als hochpathogen.

The Pathogenität der **F. oxysporum** Isolate schwankte zwischen 0-100%, jedoch lag bei 75% der Isolate eine Pathogenität von über 50% vor. **F. acuminatum** Isolate zeigten eine Pathogenität zwischen 0-100%, während nur 45% der Isolate eine Pathogenität von über 50 % aufwiesen.

Nur 40 % der untersuchten Isolate von **F. solani** und **F. redolens** zeigten eine Pathogenität von über 50 %. Die Prozentzahl der Pathogenität variirte von O bis maximal 100 %.

SCLUSSBETRACHTUNG

Die Untersuchungen zur Feststellung von Linsenkrankheiten haben gezeigt, dass die Wurzelfäule in allen Anbaugebieten schädlich und weit verbreitet ist (2,5,7,9,12). Aus diesen Untersuchungen geht hervor, dass sich je nach Umgebungsverhältnissen viele verschiedene Bodenpilze bei der Krankheit beteiligen. Als Erreger wurden bisher **Sclerotium rolfsii** (11,13), **Fusarium oxysporum** (1, 6,14), **Fusarium solani** (7), **Rhizoctonia solani** und **Pythium ultimum** (2) festgestellt.

Von diesen Erregern war **S. rolfsii** in unseren Untersuchungsbedingungen nicht zu erwarten, da das Klima für den Pilz nicht geeignet ist. Zusätzlich zu den bisher gefundenen Erregern wurden bei unseren Versuchen an erkrankten Pflanzen **F. redolens** und **F. acuminatum** isoliert. Die Isolate aus beiden Arten erwiesen sich in der geprüften Auswahl sämtlich als pathogen.

Tabelle 2. Pathogenität der Pilze

Pilze	Häufigkeit der Pilze	Anzahl der untersuchten Isolate	Pathogenität (%) max	Pathogenität (%) min	Proz. Anzahl von Isolaten mit über 50% Pathogenität
Pythium ultimum	1	10	100	80	100
Rhizoctonia solani	10	10	100	100	100
Fusarium oxysporum	44	46	100	0	75
Fusarium acuminatum	19	40	100	0	45
Fusarium solani	7	10	100	0	40
Fusarium redolens	4	10	100	0	40

ÖZET

ANKARA CİVARINDA MERCİMEK KÖK ÇÜRÜKLÜĞÜ HASTALIĞI ETMENLERİNİN TESBİTİ

Kök çürüklüğü etmenlerini saptamak amacıyla 1978 yılında Ankara civarında mercimek ekim alanları incelenmiş ve bütün bölgelerde Kök Çürüklüğü hastalığının yaygın ve etkin olduğu görülmüştür.

Toplanan hasta bitkilerden **F. oxysporum, F. acuminatum, F. solani F. redolens, R. solani** ve **P. ultimum** izole edilmiş ve yapılan patojenite testleri sonucu türlerin hastalık etmeni oldukları anlaşılmıştır.

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Investigations on the Relation Between the Zinc-deficiency and Twig Die-back Occurring on Satsuma Mandarin (Citrus unshiu Marc.) Plantations in İzmir, Variation and Severety of the Disease and Curative Methods

S. ERCİVAN[1] İ. KARACA[2]

ABSTRACT

Recently, production of Satsuma mandarins (**Citrus unshiu** Marc.) has been gained great importance in Aegean Region.

Shoot and twig die-back of Satsuma mandarins have been reached at an important level recently. Investigations on twig die-back acurring on Satsuma mandarins plantations were started in 1973 and the aim of the study was to establish the relation between the twig dieback and zinc deficiency of soil and plant. The work was completed in 1977.

The highest rate of die-back was found as 75,10 % in Gümüşsu in the orchard numbered 5 and the lowest rate was 9,75 % in the orchard numbered 9 in the same place.

Fungi belonging **Alternaria** sp., **Fusarium** sp., **Penicillium** sp. and **Pythium** sp. were isolated from twig and root samples taken from whit-

1: Regional Plant Protection Research Institute Bornova, İzmir, TURKEY.

2: University of Ege Department of Phytopathology and Agricultural Botany, Bornova, Izmir, TURKEY.

hered trees and decied that they were saprophytic agents as recorded by Mahmood (1971). Population of citrus nematode was much lower than the damage point stated by Webster (1978).

Boron level of irrigation water in orchards numbered 2,3 and 11 was at significant level but the specific symptoms of excess boron were not observed on dead trees.

Physical and fertility analysis of soil samples increased the possibility of zinc deficieny. Available zinc was found less than "I ppm" in all sampling places. In the analysis of leaves which were taken from dead trees zinc value was found below 15 ppm. generally, which was the range given for zinc deficiency by Chapman (1960). Zn 65 was applied to the leaves showing zinc deficiency symptoms then autoradio grams of the leaves were taken. The results was proved that the cause of symptoms was zinc deficiency.

According to the results of the experiments which were carried out under the field conditions it was established that climatical factors, irrigation water, citrus nematode and fungal agents were not the primary cause of die back. Results of the analysis of soil, leaf twig samples supportted the idea of zinc deficiency as the primary cause.

INTRODUCTION

Recently, production of Satsuma mandarins (**Citrus unshiu** Marc) has been gained great importance in Agean Region. According to the production data obtained until now, its development has left the other citrus production behind.

Reports for 1973 showed that the production was 34.149 tons. According to the data issued by Export Association 20.642, 620 kg fruit was exported in 1975 and 78.272.605 TL. income was obtained.

Shoot and twig die-back of Satsuma mandarins have been reached at an important level recently. A certain amount of work has been carried out on die-back which spoils the quality of fruit und decreases the yield. Mahmood (1971) and Akteke (1973) isolated **Alternaria** sp., **Phoma** sp., **Colletotrichum** sp., **Fusarium** sp., **Thieleviopsis basicola** (Berk e. Br. Ferr) from twig and root samples but it was not determined that these were the primary cause of die-back.

Azeri (1973) reported that virus diseases were not the primary cause for die-back too.

It was noticed that small leaf, interveinal chlorosis and rosetting were main symptoms on dead twigs sandy-loam structure of soil, alkaline or acidic pH nearer to neutral, low organic but rich phosphorous content of soil increased the possibility of zinc deficiency as the cause of die-back. Therefore, further investigations were needed on the pathological state of the nutrient physiology.

Investigations on twig die-back occurring on Satsuma mandarin plantations were started in 1973 and the aim of the study was to establish the relation between the twig die-back and zinc deficiency of soil and plant. Seasonal variation of disease incidence and curative methods were studied under the conditions of field and glass house. The work was complated in 1977.

MATERIALS AND METHODS

Three orchards in Seferihisar, two orchards in each of Gümüşsu, Güzelbahçe, Narlıdere and one orchard in each of Balçova and Inciraltı vicinities were chosen as the research area. Providing that the rootstock was trifoliata (**Poncirus trifoliata** Lin. Raf.) 10 diseased and 10 healthy trees were marked for the analysis of zinc content of soil, leaf and twig; also the weight of fibrous-root was established on the same trees. Five diseased and five healthy trees were selected in the same orchards for the determinations of the seasonal variation of zinc content of soil and plant. The work concerning with the application of curative methods was carried out in two orchards in Seferihisar and one orchard in Gümüşsu. Experiments were conducted in the orchards containing fruting trees.

Three-year-old Satsuma mandarins on trifoliata root stock were used in glass house experiments. Changes in root system was studied in five aquarium-like glass containers. Water perlisol and sand were used as growth medium. For zinc deficient solution Chapman et al (1937) formula and for normal solution Shive and Robbins (1942) formula was applied (Hewitt, 1966). Air - pomp of aquarium used for airing of root-system.

For the analysis of zinc Perkin-Elmer A.B.S. apparatus and for radio-active counts a Norotom counter with tallium activated NaI christa-

line detectour were used.

Zinok (70 % active zinc), Reax Zinc (12 % zinc as element) Zinc Sulphate (98 % zinc), Miltox (37 % Cu + 20 % Zineb) and Zineb W.P. (70 % Zineb) were used during the applications of curative methods.

In the research area determinations of the die-back rate based upon the method given by Karaca et al. (1972); establishment of fungal agents were carried out occording to the methods of Mahmood (1971), Fatemi (1971), Akteke (1973) and the population of citrus nematode was determined by the methods of Christie and Perry (1951) and Young (1954). Irrigation water analysis was carried according to the methods given by Chapman and Pratt (1971). Method of Bauyocos (1962) was used for the determination of structure of soil samples; lime rate was found according to Çağlar (1949), soluable salt % established by the methods given in Soil Survey Staff (1951), Soil reaction was found as mentioned by Jackson (1962) capacity of cation change was determined according to Black Evans (1965); determinations of organic material was based on methods of Reuterberg, Kremkus (1951), methods of Olsen (1954) were used for the establishment of available phosphorous and available potassium was determined according to the method given by Schouwenburg (1961).

Methods given by Steyn (1957) were used for washing and drying of samples. Grounding and preparing for the analysis were carried out according to Steyn (1959). Fresh-burning was done with the mixture of Nitric-Perchloric acid as mentioned by Kaçar (1972). Atomic Absorbtion Spectro photometer method was used for the determination of zinc and mangenese values (Perkin-Elmer, 1973).

Under the field conditions radioactive Zn65 was given to the shoots in 200 cc. distilled water in flasks in which the shoots were dipped for one week and then the nearest shoot was cut off. In glass house experiments Zn65 was given to the medium containing roots of plant and 10 microcuri activity was calculated per pot (Steward; Leonard; Edwards, 1955). Autoradiograms of the parts of both samples taken from field and glass house were taken by using Non-Screen - X - Ray films (Comar, 1955). Radio - activity counts were carried out on the other parts of samples (IAEA Technical Reports, 1964). The results were assayed according to Senvar (1964).

During 1973-1976 optimum, maximum, minimum temperatures and relative humidity were recorded by using thermohygrographs placed in certain localities.

In the studies of seasonal variation of zinc, four leaves of one-year-old shoots were taken begining from the top (Bathurst, 1955; Chapman, 1961; Özbek, 1969). Samples were collected in July, September, April and February. Determinations of the symptomatological intensity of zinc deficiency of trees were made on marked shoots according to the scale applied by Ercivan (1972) and given in Figure 1.

Experimental methods were applied to determine the severety of the disease. Total yield of diseased and healthy trees, the mean of the fruit weight and fruit number were established. Disease rate was determined according to the methods given by Bora, Karaca (1970) and Karman (1971). The method of Azeri (1976) was applied for fruit calculations. The yield of diseased and healthy trees were applied to Klemm formula in order to obtain the disease severety (Chester, 1950) and for symptom showing trees "Expected crop" and "Crop-Loss" were established.

Leaf and soil treatments were applied during the applications of curative methods. A separate experi-

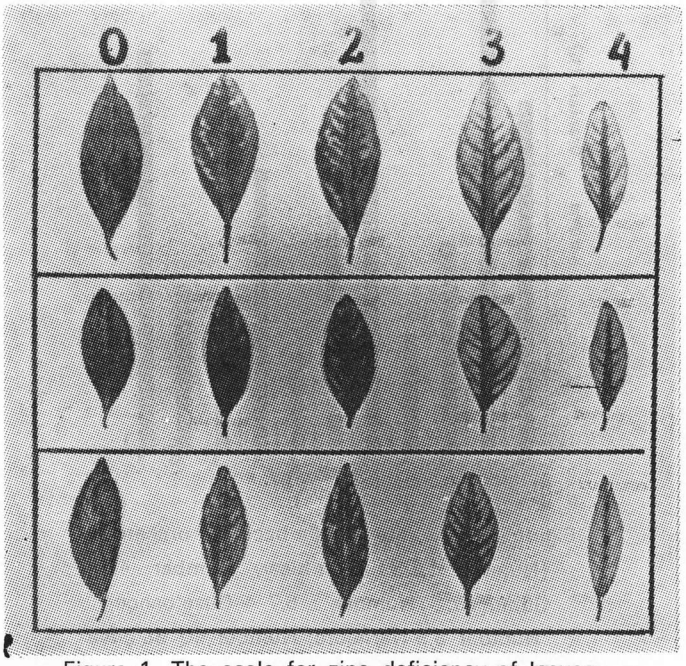

Figure 1. The scale for zinc deficiency of leaves

ment was carried out in order to find most suitable time for chemical application according to phenological periods (before and after blossoming) Leaf treatment was applied once during last blassoming period. Soil treatment was applied at the beginning of Spring according to fertilizing method.

RESULTS

First of all, the rate of die-back in the research area was established in order to find out the primary cause for die-back (Fig. 2).

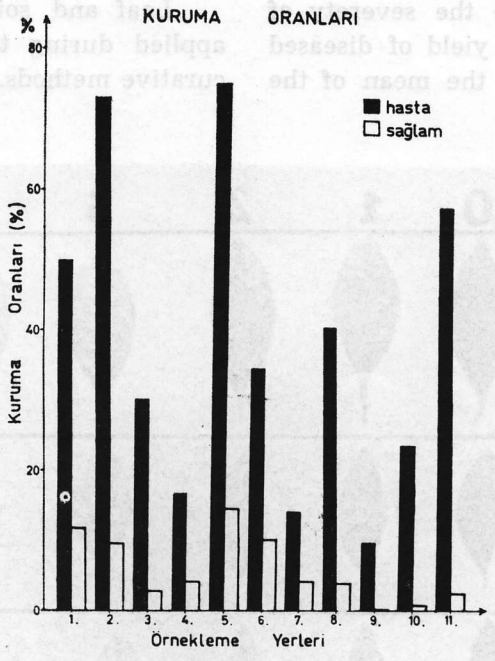

Figure 2. The rate of die-back in orchards (Number 1,2,3 Sefer hisar; Number 4,5 Gümüşsu; Number 6,7 Güzelbahçe Number 8,9 Narlıdere; Number 10 Balçova Number 11 İnciraltı).

The highest rate of die-back was found as 75,10 % in Gümüşsu in the orchard numbered 5 and the lowest rate was 9,75 % in the orchard numbered 9 in the same place.

In the experiments on fungal agents **Alternaria** sp., **Fusarium** sp., **Penicillium** sp. and **Pythium** sp. were isolated from twigs and root samples of trees.

Citrus nematode (**Thylenchulus semipenetrans** Cobb.) was counted in soil samples taken from each orchard and 1098 nematodes in 3rd stage were established only in third orchard.

In the analysis of irrigation water Boron level was found as 1,40 ppm in second and 3,80 ppm in 11 th orchards. The salinity was found at the level of T_4 (highest level) in 6th, and 8th orchard and the level of T_3 (high level) was found in the orchards numbered 2,5,7,9 and 10.

Physical and fertility analysis of soil samples taken from 0-30 and 0 60 cm depth indicated a sandy - loam structure. The highest total salinity was 0,072 %. It was established that the lowest pH= 6,20 and the highest was pH= 7,80. The highest value for lime was 2,49 %. The percentage of organic material was found 1,97 as highest and 0,26 as lowest. Available P_2O_5 value was above 10 kg/dk generaly. Available K_2O values were 116,53 kg/dk as the highest and 4,10 kg/dk as the lowest.

Available zinc in soil was found less than "1ppm" in all sampling places. It was established that the available zine was 0,75 ppm in 0-30 cm depth of soil in 5 th orchard where the highest level of die back (75,10 %) was found.

Generally, in analysis of leaves, taken from die-back showing trees, zinc value was below the range given for zinc deficiency by Chapman (1960) and Sato et al. (1952).

Zinc and manganese values of diseased twigs were lower than the healthy twigs.

Zn 65 was applied to the leaves in Seferihisar number 2 orchard. Results of radioactivity on leaves were given on Table (1).

Any climatic change was not observed in the investigation area that could be the cause of die back.

In glass house studies zinc deficiency symptoms were obtained on leaves, twigs and fruits of the seedlings which were grown in water and sand clutures, and also Perlisol mediums (Fig. 3,4,5,6).

Zinc values of the leaves of seedlings in green house were assayed by applying O.M.18 program and the results were summarised on table 2.

Table 1. Results of Zn65 Radioactivity on leaves

Number Of Twig	Symptom on leaf	Mean of C.p.m	Mean Backgraund	C.p.m (in 1gr.)
RA-1/1	+	1133	763	1051
RA-1/2	—	867	763	693
RA-1/4	+	1257	763	1008
RA-2/3	+	1329	763	1166
RA-2/4	—	1095	763	968

Table 2. Combined analysis of the results of experiments conducted at different stages in glass house

F. value						L.S.D. test	
Stage	Interac-	Variety	Number	Varieties	Variety	mean	Groups
93,863	2,387	8,325	2	N.S.	43.160	43.160	A
			1	E.S.	33.100	33.100	B
13.881	1,804	1,722	2	N.K.	11.267	11.267	A
			1	E.K.	8.935	8.935	B

N.S. Normal water medium
E.S. Zinc deficient water medium
N.K. Normal sand medium
E.K. Zinc deficient sand medium

Zn65 was applied to the seedlings showing symptoms in zinc deficient medium in glass house and the results of radio - activity calculations were determined (Table 3).

Table 3. Results of radioactivity of Zn65 calculations on leaves

Sample number	Symptom on leaves	Medium	Mean C.p.m.	Mean Background	C.p.m (1 gr)
15	+	zinc deficient Perlisol	1126	763	726
16	—	Normal Perlisol	840	763	229
N_2	+	Normal Sand	859	763	211
E_2	+	zinc deficient Sand	961	763	717
E_5	+	zinc deficient water	1262	763	898
E_5	—	Normal water	1093	763	660

Available zinc value in soil was established in February and this value increased in April and decreased in July then increased in September again. Zinc values of leaves were fluctuated paralel to these values (Fig. 7).

Studies conducted under the field conditions indicated that the relation between the amount of fibrous-root in 30 cm depth of soil and the amount of zinc in leaf was significant.

Using the 0-4 scale in research area the highest index value of zinc deficiency was found as 2,28 and disease severety as 57,18 %.

It was established that zinc deficiency was affected fruit yield (Fig. 8).

It was established that number of fruit, total yield as kg, and mean weight of individual fruit were decreased as 79,10 %, 79,70 % and 42,60 % respectively. Crop losses were recorded as 2279 fruits, 175,10 kg total fruit weight and 35,18 gr mean weight of individual fruit. From the finalcial point of view it was estimated that the highest value of crop-loss was 875,50 TL in an orchard for every 10 trees.

In Fig. 9 the comparison of fruits which were obtained in sand and water mediums was shown.

Figure 3. Zinc deficiency symptoms occurring as interveinal chlorosis on the leaves of seedlings grown in zinc deficient water culture.

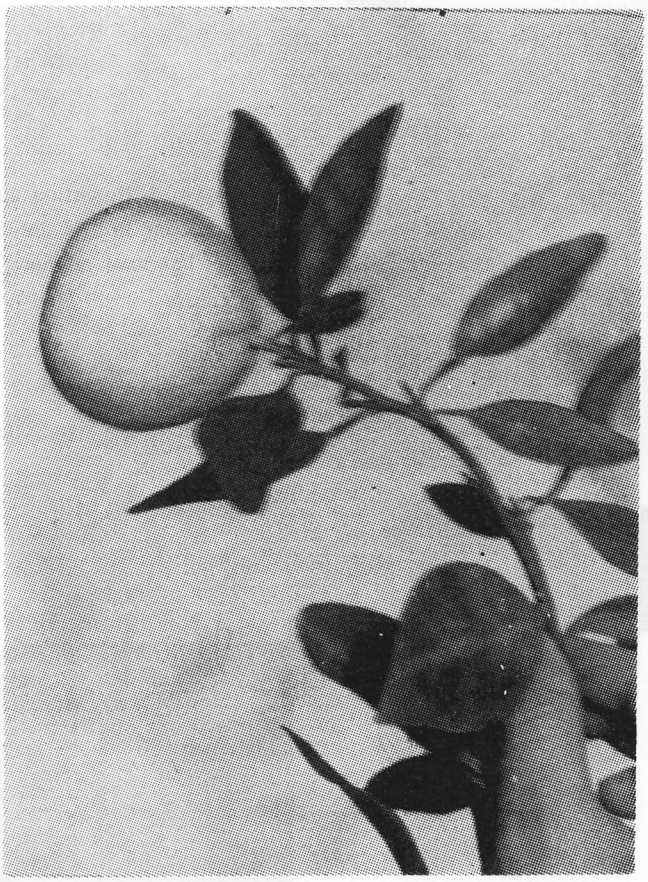

Figure 4. Interveinal chlorosis on leaves of fruit bearing shoots grown in zinc deficient water culture.

Figure 5: Rosetting and tufted leaves occurring in zinc deficient perlisol medium.

Figure 6. Bareness of twig, small leaf and rosetting symptoms in zinc deficient water culture.

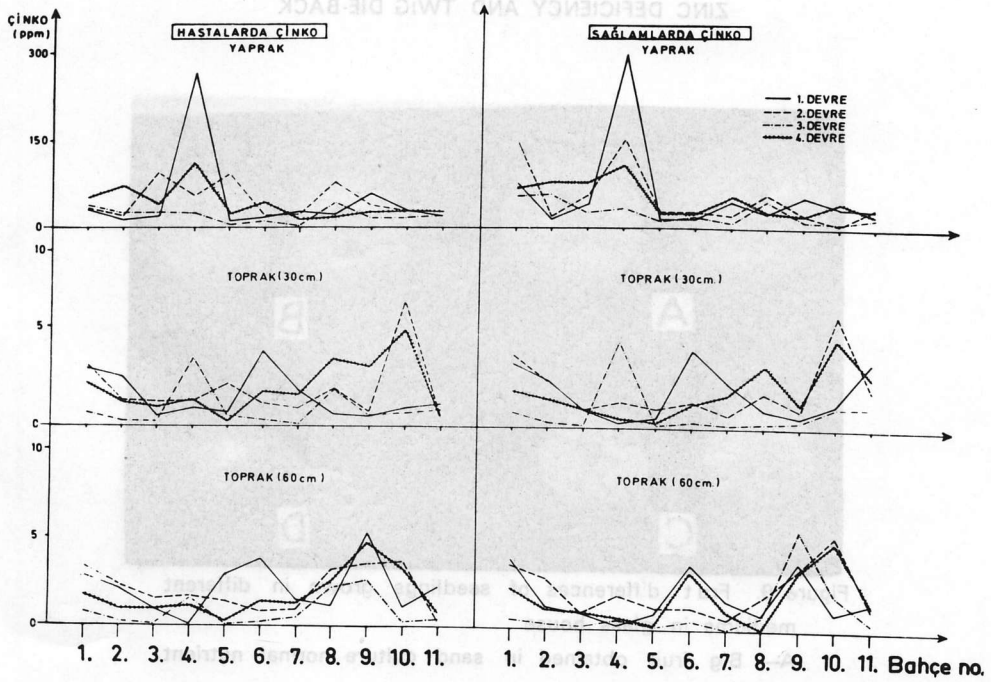

Figure 7. Changes of zinc value of soil and leaf in four different period.

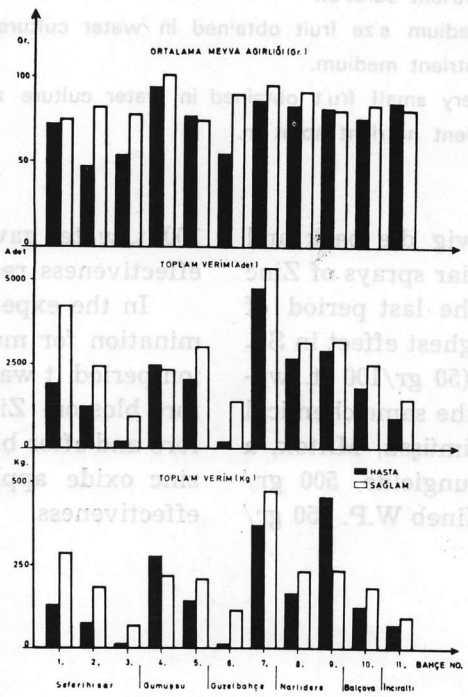

Figure 8. Fruit yield diagram of orchards

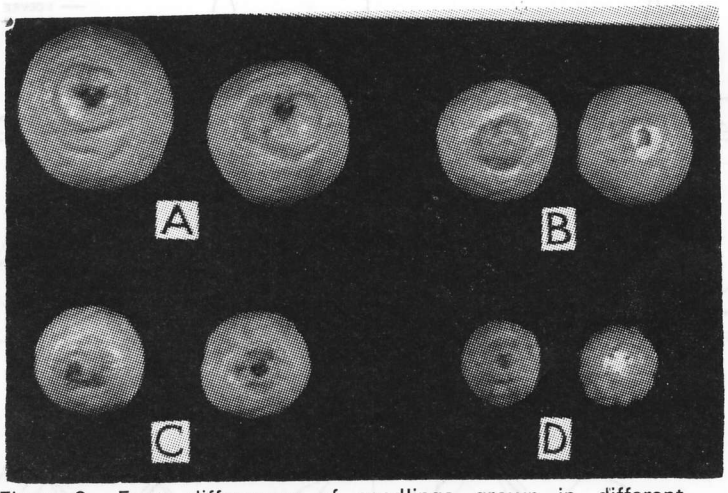

Figure 9. Fruit differences of seedlings grown in different mediums in glass house

A— Big fruit obtained in sand culture normal nutrient medium

B— Small fruit obtained in sand culture zinc deficient nutrient solution

C— Medium size fruit obtained in water culture normal nutrient medium.

D— Very small fruit obtained in water culture zinc deficient nutrient solution.

To cure the twig die back and other symptoms foliar sprays of Zinc Oxide applied at the last period of flowers gave the highest effect in Seferihisar as 99 % (50 gr/100 lt. water). The effect of the same chemical was 90,12 % at Gümüşsu, Miltox, a zineb containing fungicide, 500 gr/ 100 lt. water and Zineb W.P. 250 gr/ 100 lt. water gave 93,06 % and 100 % effectiveness respectively.

In the experiments of the determination for most suitable application period it was established that before blossom Zinc Sulphate and before and after blossom Zinc Sulphate zinc oxide applications gave 100 % effectiveness.

DISCUSSION

It was decided that fungal agents and viruses were not the cause of die back and zinc deficiency symptoms were permanent on whitered twigs and leaves (Mahmood, 1971; Akteke, 1973; Azeri, 1973). This led the studies to concentrate on this subject.

Population of citrus nematode (**Thylenchulus semipenetrans** Cobb.) was determined in soil samples taken from each orchard of research area and found that it was much lower than the damage point stated by Webster (1972). Therefore it can be said that the damage caused by nematodes is not significant.

Boron level of irrigation water in orchards numbered 2, 3 and 11 was at significant level but the specific symptoms of excess boron were not observed on dead trees. Although the salinity was at the level of T_4 (high salinity) in the orchards of number 6 and 8 the effect was not reflected on plants.

Physical and fertility analysis of soil samples increased the possibility of zinc deficiency. Available zinc was found less than "1 ppm" in all sampling places. Obtained data indicated the zinc deficiency values (Shaw and Dean, 1942; Wear and Sommer, 1947) It is notable that the available zinc was 0,75 ppm in 0-30 cm. depth of soil in the number 5 orchard where the highest rate of die back (75,10 %) was found.

In the analysis of leaves which were taken from dead trees zinc value was found below 15 ppm generally which was the range given for zinc deficiency by Chapman (1960) and Sato et al (1952). These results were supported the idea of zinc deficiency in plants as cause of die back. Zn65 was applied to the leaves showing zinc deficiency symptoms then autoradiograms of the leaves were taken, The result was proved that the cause of symptoms was zinc deficiency.

According to the results of the experiments which were carried out under the field conditions it was established that climatical factors, irrigation water, citrus nematode and fungal agents were not the primary cause of die back. Results of the analysis of soil, leaf and twig samples supported the idea of zinc deficiency as the primary casue.

In glass house studies fruting satsuma mandarin seedlings were grown in sand, water and perlisol media and irrigated with zinc containing and zinc deficient nutrient solutions and die back like symptoms were obtained. Although the seed-

lings developed normally in zinc containing media, twig die back, leaf-fall, interveinal chlorosis, rosetting, bearness of shoots and small leaf symptoms were observed on seedlings grown in zinc deficient media (Fig. 3, 4, 5, 6). These symptoms were known as typical symptoms of zinc deficiency (Bryan, 1961; Norman, 1949; Klotz, 1961; Platt, 1968; Reuther, 1968; Vardar, 1972). These resutls were analysed statistically and determined that the cause was zinc deficiency. Autoradiograms were also supported this determination.

It was established that zinc value changes according to the depth of soil, period of sampling and sampling places. Available zinc value of soil established in February, increased in April, decreased in July and increased in September again (Fig. 7). The cause of this variation is the seasonal variation of the growth of fibrous root. In the present study a positive relation was found between the quantity of fibrous - roots and zinc content of leaves in second period but this relation was negative in third period.

Obtained results were indicated that zinc deficiency affected the yield and quality of fruit.

According to the results of the studies on curative methods zineb containing fungicides can be used as leaf sprays. Because of its phytotoxic effect and preparation difficulties of Zinc Sulphate, it is decided that the application of Zinc Oxide and Zineb containing fungicides is the best method.

Leaf treatments were most effective way to cure the zinc deficiency. Reflection of soil treatments on plants is not as good as expected It was established that one application of Zinc oxide as foliar spray just after blossoming is most suitable time for control.

ÖZET

İZMİR İLİ SATSUMA MANDARİN (**CITRUS UNSHRU** MARE) PLANTAJLARINDA GÖRÜLEN ÇİNKO NOKSANLIĞININ DAL KURUMLARI İLE İLGİSİ, HASTALIK VARYASYONU, ZARAR DERECESİ VE İYİLEŞTİRME YÖNTEMLERİ ÜZERİNDE ARAŞTIRMALAR

Ege Bölgesinde Satsuma Mandarini üretimi son yıllarda oldukça önem kazanmıştır.

Sürgün ve dallarda geriye doğru kurumalar önemsenecek bir düzeye ulaşmıştır. Satsuma mandarin plan-

tasyonlarında sürgün kurumaları üzerindeki çalışmalara 1973 yılında başlandı. Çalışmaların gayesi toprak ve bitkideki çinko noksanlığı ile kurumaların ilişkisini saptamaktı. Çalışmalar 1977 yılında tamamlandı.

Araştırma alanı olarak Seferihisarda üç, Gümüşsu, Güzelbahçe, Narlıderede iki, Balçova ve İnciraltın'da bir bahçe seçildi. Bu bahçelerde anacı üç yaprak (**P. trifoliata** Lin. Raf.) olan ağaçlar alındı.

Diğer taraftan serada anacı üç yaprak olan 3 yaşındaki Satsuma mandarin fidanları çinko noksanlığı veren ve normal solusyonlar içinde denemelere alındı (Hewitt 1966).

Çinko analizleri için Pekkin-Elmer A.b.s ve radyoaktif sayımlar için ise Norotom sayacı kullanıldı. İyileştirme çalışmaları Zinok Reax Zinc, Zinc Sulphate, Miltox ve Zineb W.P preparatları ile yapıldı.

Araştırma alanındaki kuruma oranının saptanmasında Karaca et al (1972) fungal etmen aramada Mahmood (1971), Fatemi (1971), Akteke (1973) turunçgil nematodu Christie and Perry (1951) ve Young (1954) nematodları kullanıldı. Sulama suyu analizinde Chapman and Pratt (1971) toprak yapısı Bauyoucos (1962), Kireç Oranı Çağlar (1949), Tuzluluk Soil Survey Staff (1951) Toprak reaksiyonu Jackson (1962), Organik Material Reuterberg, Kremkus (1951) faydalanılabilinir Fosfor Olsen (1954) Potasyum Schouwenburg (1961) metodlarıyla yapıldı.

Autoradyagramların çekiminde Non-Screen-X Ray filmi kullanıldı.

En yüksek kuruma oranı % 75,10 olarak Gümüşsuda 5.nolu bahçede ve en düşük oran da % 9,75 olarak yine ayni yerdeki 9. numaralı bahçede bulundu.

Kök ve sürgün örneklerinden **Alternaria** sp., **Fusarium** sp., **Penicillium** sp. ve **Pythium** sp. fungusları izole edildi. Ancak saprofit oldukları görüldü. Turunçgil nematodu populasyonunun da Webster (1972)'nin verdiği sınırın altında bulundu. Sulama sularında Bor miktarı 2,3 ve 11 bahçelerde önemli düzeyde olmasına karşın hastalıklı ağaçlarda Bor Noksanlığı özel simptomlarına rastlanmadı.

Toprağın fiziksel ve verimlilik analiz sonuçları ise çinko noksanlığı verebilecek düzeyde bulundu. Topraktaki faydalanılabilinir çinko ise genellikle 1 ppm. değerinin altında hastalıklı yapraklarda ise Chapman (1960) göre en düşük sınır olan 15 ppm değerinin altında çinko saptandı.

Zn 65 uygulanan simptomlu yaprakların autoradyogramların da bu noksanlığı kanıtlayıcı sonuçlar verdi.

Araştırma sonuçlarına göre iklim faktörlerinin, sulama suyunun turunçgil nematodunun ve fungal etmenlerin kurumalarda primer neden olmadıkları görüldü. Toprak, yaprak ve sürgün analizleri ise primer etkenin çinko noksanlığı olduğunu ortaya koydu.

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Some Results of Fungicide Tests on Phytophthora capsici Leon. of Pepper[1,2]

Mehmet YILDIZ[3] Nafiz DELEN[3]

ABSTRACT

The study is concerned with, the effects of some fungicides on **Phytophthora capsici** Leon. The studies were carried out in the pot culture as well as in the field conditions. At the end of the pot experiments, Pomarsol forte, Brestan Cons., Previcur and Aliette gave the positive results. In the field conditions Pomarsol forte (3 times); Brestan Cons. (3 times); Previcur-Pomarsol forte- Pomarsol forte; Previcur-Brestan Cons- Brestan Cons.; Aliette- Pomarsol forte- Pomarsol forte were found effective.

INTRODUCTION

Since 1960, pepper plantations of Turkey have been affected by a serious drying problem (7,12,15,17, 25). For example, the mean of the drying plants are 29,19 % for Manisa (20) and 45,00 % for Aydın district (21). The main causal agent of this disease complex is **Phytophthora**

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2) Supported by the Faculty of Agriculture, University of Ege

3) Department of Phytopathology and Agricultural Botany, Faculty of Agricultura, University of Ege İzmir/TURKEY

capsici Leon (7,17). It was shown by Saydam and Copçu (23) that **Verticillium dahliae** Kleb. also have an important role in the dryings. Accord ing to our earlier study, although, **P. capsici** was the main agent of the pepper dryings, but more or less **Rhizoctonia solani** and **Fusarium** spp were also effective organisms (12). It was also found as a result of our isolation studies and pathogenicity tests, **V. dahliae** isolated from the samples taken from Manisa, were highly virulent on pepper plants.

In Turkey and in other countries besides finding out disease resistant varieties and other cultural measures (2,5,6,9,18,19,22), chemical control was also being investigated and it was mainly against **P. capsici.** Nabam, captafol (3), aluminium ethylphosphite, prothiocarb (4) gave the possitive results in the studies done abroad. But in Turkey, triphenyltinacetate gave the best result (8,9,10), and mancozeb was also found to be prospective (25).

This study which was aimed to control the pepper dryings in Ege region, was carried out in the pot and field conditions. The fungicides found to be phytotoxic or less effective in the pot experiments, were not being tested in the field conditions.

MATERIALS AND METHODS

The fungicides included in the experiments, along with their characteristics, are shown in the Table 1.

Table 1. Some Characteristics of the tested fungicides

Fungicide's			
Trade Name	Company	Active Ingradient	Formulation Type
Antracol	Bayer-Tarım	70 % Zincpropylenebisdithio-	W.P.
Pomarsol forte	Bayer-Tarım	carbamate	
Previcur	Schering A.G.	80 % Thiram (T.M.T.D.)	W.P.
Brestan Cons.	Türk-Hoechst	70 % Prothiocarb	L.
Trifen 60	Tarkim	54 % Triphenyltinacetate	W.P.
Dexonal	Bayer-Tarım	60 % Triphenyltinacetate	W.P.
Aliette (LS 74783)	Rhone-Poulenc	2,5 % Dexon+10 % PCNB	Powder
	Pytosanitarie	80 % Aluminiumethylphas-	W.P.
		phite	

The pot cultur studies were carried on bell pepper plants, grown in 17 cm diameter clay pots, but field experiments were performed on red pepper plants were grown in natural infected field. The pathogenicity of **P. capsici** isolate which was used in the pot studies, had been determined by Delen and Yıldız (12).

In all of the three pot experiments randomized plot design was applied and every replication contained one plant in a pot. The first pot experiment was conducted at 10 replications. The chemicals were applied to the plants only once, before or after the inoculation. The fungicides, their doses and application times are shown in Table 2.

On the basis of the results obtained from the first experiment, second pot study was conducted. In this study, fungicides were applied singly or in combinations, one or more than one time, and pots were inoculated 3 times. Only in the second and the third inoculations, 1/4 petri concent of **P. capsici** culture was mixed with 25 ml. water for each pot. Second and third inoculations were done 2 and 4 weeks after the begining of the trial, respectively. More information concerning the lay-out of the second pot experiment can be seen in Table 3. This experiment was conducted at 16 characters with 8 replications.

Third pot culture study and the field experiment were conducted at the same time. The chemicals which gave the positive results in previous tests, and a new systemic fungicide Aliette were tested. Every 20 days, chemicals were applied 1 or 3 times, singly or in combinations. The trial carried on as 13 characters and 10 replications. In table 4, more information was given on the characters.

In all the pot culture studies chemicals were applied with 200 ml. water as drenching. Inocula were prepared as Delen and Yıldız (12), except second and third inoculations of the second pot study. The plants, were checked everyday, and percentage of the infected plants were recorded.

The fungicides which were found prospective in the pot studies, were tested in the field conditions, singly or in combinations. In the field tests randomized plot design was applied with 7 characters and 4 replications. Every replication contained 40 plants More detail on the characters of this study were given in table 5. The applications were done by the pulverizer in every 20 days. During the application, the nozzel of the pulverizer had been taken out, and 100 ml. liquid was given in the collar root zone of every plant. Twenty days after the first application, 10 days and 20 days after the second application and 10 days after the third application healty and infected plants were recorded.

RESULTS

In the first pot study records, were taken 15,30 and 51 days after the inoculation, percentages of the infected plants were summarized in the Table 2.

Table 2. In the first pot culture study, the percentages of infected plants, different days after inoculation

Characters			Days after inoculation 15	30	51
1.Antracol	0.4g/plant	A.1	0	0	0
2.Antracol	0,8g/plant	A.1			
3. Pomarsol forte	0,4g/plant	A.1	0	0	0
4.Pomarsol forte	0,8g/plant	A.1	0	0	0
5.Previcur	0,3ml/plant	A.1	10	20	60
6.Previcur	0,6ml/plant	A.1	0	0	10
7.Previcur	0,3ml/plant	B.1	0	0	10
8.Previcur	0,6ml/plant	B.1	10	10	10
9.Brestan oCns.	3mg/plant	A.1	30	50	50
10.Brestan cons.	6mg/plant	A.1	10	30	50
11.Brestan cons.	3mg/plant	B.1	20	30	40
12.Brestan cons.	6mg/plant	B.1	10	30	40
13.Triften 60	3mg/plant	A.1	40	60	80
14.Trifen 60	3m/plant	A.1	30	30	30
15.Trifen 60	3mg/plant	B.1	30	50	60
16.Trifen 60	6mg/plant	B.1	0	20	20
17.Dexonal	18mg/plant	A.1	20	20	80
18.Dexonal	36mg/plant	A.1	60	100	100
19.Control (inoculated)			60	90	90
20.Control (non inoculated)			0	0	0

A.1 : After inoculation
B.1 : Before inoculation

Table 3. In the second pot culture study, the percentage of the infection, from the records taken on the different dates

Characters			Days after inoculation 13	27	41	72
1.Pomarsol forte	0,4 g/plant	1 time	12,50	12,50	12,50	12,50
2.Pomarsol forte	0,4 g/plant	5 times	0	0	0	12,50
3.Pomarsol forte	0,4 g/plant	First week				
Previcur	0,3ml/plant	Second week				
Pomarsol forte	0,4 g/plant	Fifth week	0	12,50	12,50	12,50*
4.Antracol	0,4 g/plant	1 time	0	0	0	0
5.Antracol	0,4 g/plant	5 times	12,50	12,50	12,50	12,50**
6.Antracol	0,4 g/plant	First week				
Previcur	0,3ml/plant	Second week				
Antracol	0,4ml/plant	Fifth week	0	12,50	37,50	37,50
7.Brestan Cons.	50mg/plant	1 time	0	0	0	0
8.Brestan Cons.	50mg/plant	5 times	0	0	12,50	12,50
9.Brestan Cons.	50mg/plant	First week				
Previcur	0,3ml/plant	Second week				
Brestan Cons.	50mg/plant	Fifth week	0	0	0	0
10.Previcur	0,3ml/plant	1 time	12,50	12,50	12,50	50,00
11.Previcur	0,3ml/plant	First and Fourth weeks	0	0	0	12,50
12.Previcur	0,3ml/plant	First week				
Pomorsal forte	0,4 g/plant	Fourth and Fifth weeks	0	0	0	12,50
13.Previcur	0,3ml/plant	First week				
Antracol	0,4 g/plant	Fourth and Fifth weeks	0	0	0	12,50
14.Previcur	0,3ml/plant	First week				
Brestan Cons.	50mg/plant	Fourth and Fifth weeks	0	0	0	25,00
15.Control (inoculated)			20,00	30,00	70,00	100,00
16.Control (non inoculated)						

* : Slide necrosis around the leaves due to phytotoxity

** : Severe necrosis around the leaves and in the veins due to phytotoxity

As evident from Table 2,51 days after the inoculation, 90 % of the control plant died, but the plants which were treated with Antracol (0,4 g/plant) and Pomarsol forte (0,4,08 g/plant) were healty. On the other hand, phytotoxic symptoms appeared in the plants which were treated with Antracol (0,8 g/plant) and Dexonal (especially 36 mg/plant).

On the basis of the results from the first pot experiment, Dexonal due its phytotoxic effect and low activity and Trifen 60 due to its same chemical structure and activity with that of Brestan Cons., were excluded from the subsequent experiments. In the second pot study, percentage of the infected plants, 13,27,41 and 72 days after the inoculation were given in the Table 3.

According to the Table 3, Pomarsol forte, especially Brestan Cons. were the most effective chemicals. Antracol was also found to be effective, but it was a little phytotoxic.

The chemicals which gave somewhat positive results in the previous tests were used in the third pot study 10, 30, 50 and 60 days after inoculation, percentage of the infected plants were recorded (Table 4).

Table 4. In the third pot culture study, the percentage of the infection, from the records, taken on different dates

Characters			Days after inoculation 10	30	50	60
1.Pomarsol forte	0,4 g/plant	1 time	0	0	0	0
2.Pomarsol forte	0,4kg/plant	3 times	0	0	20	20
3.Brestan Cons.	0,62g/plant	1 time	0	0	0	10
4.Brestan Cons.	0,62g/plant	3 times	0	20	20	20
5.Aliette	0,5 g/plant	1 time	0	10	20	20
6.Aliette	0,5 g/plant	3 times	0	20	20	20
7.Aliette	0,25g/plant	3 times	20	60	90	90
8.Previcur	0,3ml/plant	1 time	0	10	30	6
9.Previcur	0,3ml/plant	3 times	10	20	40	40
10.Previcur	0,3ml/plant	First aplication				
Brestan Cons.	0,62g/plant	Second and third aplications	10	60	60	70
11.Aliette	0,5 g/plant	First aplication				
Pomarsol forte	0,4 g/plant	Second and third aplications	0	30	40	40
12.Control (inoculated)			50	90	100	100
13.Control (Non inoculated)			0	0	0	0

According to Table 4, Pomarsol forte, Brestan Cons. and Aliette (0,5 g/plant) were the effective chemicals.

Pomarsol forte, Brestan Cons. Previcur and Aliette which were the effective chemicals in the pot studies were tested in field conditions. The results of this study was summarized in Table 5.

Table 5. In the field conditions, the percentage of the infection, from the records, taken on different dates

	Dates of the Records	Mean Percentage of the infected Plants	Mean Percentage of Effectivenes
1.Pomarsol	20.7.1978	0,00	100,00
0,4 g/plant 3 times	31.7.1978	1,93	93,08
	10.8.1978	8,36	89,56
	21.8.1978	32,00	67,15
2.Brestan	20.7.1978	0,00	100,00
0,62g/plant 3 times	31.7.1978	1,25	95,00
	10.8.1978	10,00	87,00
	21.8.1978	27,50	71,77
3.Previcur 75ml/100lt.	20.7.1978	6,90	66,55
Pomarsol 0,4 g/plant	31.7.1978	10,64	61,87
Pomarsol 0,4 g/plant	10.8.1978	19,20	76,04
	21.8.1978	35,35	63,72
4.Previcur 75ml/100lt.	20.7.1978	3,75	81,80
Brestan 0,62g/plant	31.7.1978	5,62	79,86
Brestan 0,62g/plant	10.8.1978	14,48	81,93
	21.8.1978	34,60	64,49
5.Aliette	20.7.1978	0,62	96,99
0,5 g/plant 3 times	31.7.1978	7,50	73,12
	10.8.1978	44,42	44,57
	21.8.1978	62,60	35,75
6.Aliette 0,5 g/plant	20.7.1978	0,62	96,99
Pomarsol 0,4 g/plant	31.7.1978	4,43	84,12
Pomarsol 0,4 g/plant	10.8.1978	13,38	83,30
	21.8.1978	26,80	72,49
7.Control	20.7.1978	20,63	—
	31.7.1978	27,91	—
	10.8.1978	80,15	—
	21.8.1978	97,44	—

The results indicate (Table 5) that Aliette-Pomarsol forte-Pomarsol forte aplications, 3 aplications of Bestan Cons., and 3 aplications of Pomarsol forte were effective 72,48 %, 71,77 % and 67,15 % respectively.

The results of the statistical analysis are:

Aliette-Pomarsol forte-Pomarsol forte	A
Brestan Cons. (three times)	A
Pomarsol forte (three times)	A
Previcur-Brestan.-Brestan Cons.	A
Previcur-Pomarsol forte-Pomarsol forte	A
Aliette (three times)	B
Control	C

DISCUSSION

Tripheyltinacetate and thiram were found effective against the **P. capsici** in our experiments. Triphenyltinacetate (Brestan) had been also found active against the pathogen (9,10,25), but according to Çınar and Biçici (9,10) thiram (Pomarsol forte) were not found so active in the field conditions. On the other hand, Antracol which was slightly phytotoxic, gave somewhat positive results in the pot studies Yalçın and Evcil (25) took good results from Dithane M 25 against **P. capsici,** and Dithane Z78 was found effective against **Phytoph thora** spp. pathogenic to Cucurbits, by Alavi (1). According to there results, dithiocarbamates are seen as effective fungicides for the control of **P. capsici.** But, human health point of view, this group of fungicides must be used carefully (11,16,24).

Clerjeau and Byries (4) found that, Aliette is an effective was systemic fungicide against **P. capsici.** In their studies, they applied Aliette 3 times, once in a week. But in our studies, due to the economic considerations, the fungicide was used in every 20 days. Because of this less aplication, the activity of the fungicide may became low.

According to Çınar and Biçici (9) tin is taken up by the pepper plants

and translocated to the fruits correlated with the number of the applications. On the other hand, tin has harmful effects to human body, soil fauna and soil microflora (13,14). For these reasons, besides organotin fungicides, activities and side effects of dithiocarbamates and aluminium ethylphosphite must be investigated in the peper plants and, combinations of these fungicides must be tested along with cultural measures against **P. capsici.** Perhaps, this aplication type can be found more effective, and the side effect problems of the chemicals will be salved.

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ÖZET

BİBERLERDE **Phytophthora capsici** Leon.'YE KARŞI İLÂÇ DENEMELERİ

Phytophthora capsici tarafından biberlerde meydana getirilen kök ve kök boğazı çürüklüğünü önlemek amacıyla yapılan bu çalışma, 1977-1978 yıllarından önce saksı ve sonra tarla koşullarında yürütülmüştür. Saksı denemeleri sonucu Pomarsol forte, Brestan Cons., Previcur ve Aliette olumlu sonuç vermişlerdir. Deksonal çok şiddetli, Antracol da biraz fitotoksik olmuşlardır. Saksı denemelerinde olumlu sonuç alınan Pomarsol forte, Brestan Cons., Previcur ve Aliette, tarla denemelerinde değişik kombinasyonlar halinde denenmişlerdir. 20 gün ara ile 3 ilâçlamanın yapıldığı denemelerde; Pomarsol forte (0,4g/bitki) ortalama % 67,15; Brestan Cons. (0,62g/bitki) ortalama % 71,77; Previcur (0,075ml/bitki) Pomarsol forte-Pomarsol forte kombinasyonu ortalama % 63,72; Previcur-Brestan Cons.-Brestan Cons. kom binasyonu ortalama % 64,49 ve Aliette (0,5g/bitki) - Pomarsol forte-Pomarsol forte ise ortalama % 72,49 etkililik göstererek, en etkili karekterler olmuşlardır.

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In Vitro and In Vivo Investigations on the Antagonism of Aspergillus flavus Link. and a Penicillium sp. against Phytophthora capsici Leon.

Atilla ATAÇ

Regional Plant Protection Research Institute
Diyarbakır—TURKEY

ABSTRACT

The antagonistic effect of **A. flavus** and **Penicillium** sp. against **P. capsici** were investigated for biological control. **In vitro** studies were carried out on PDA medium in petri dishes, under the laboratory conditions, and it was determined that the ratios of inhibition were 50.28 % for **A. flavus** and 35.00 % for **Penicillium** sp. On the other hand, **A. flavus** was very effective (100.00 %) on the incidence of the disease caused by **P. capsici,** but **Penicillium** sp. and **A. flavus** which was tested together with **Penicillium** sp. were less effective **in vivo** studies which were carried out in pots, under the greenhouse conditions.

INTRODUCTION

In this study, the antagonistic effects of **A. flavus** and a **Penicillium** sp. against **P. capsici,** crown rot pathogen of pepper plants **(Capsicum annuum** L.) were investigated **in vitro** and **in vivo,** in order to evolve a biological control.

MATERIALS AND METHODS

P. capsici which was isolated from diseased pepper plants in Lice town of Diyarbakır and **A. flavus** and a **Penicillium** sp. which were isolated from the soil, were used as material in the study.

In Vitro Studies: The study was carried out in petri dishes which contain PDA (200 g potato, 15 g dextrose, 16 g agar) and seven replications were made for each potential antagonist.

P. capsici and each one of the fungi were planted on the agar plates at a distance of 6 cm. The discs of 5 mm in diameters which were taken from 7 days old colonies of **P. capsici** and **Penicillium** sp. were used as inoculum. For **A. flavus,** the spore masses which were taken by a needle, soaked with steril water, were used.

The fungi, incubated at 20∓2°C, were controlled every day. From the 6th day when the inhibition began, the colonial diameters of **P. capsici** were measured and noted. When the colonial growth ceased, about 11 days after planting, the measurements were discontinued and the ratios of inhibition were calculated according to Abbott.

In Vivo Studies: The experiment was designed on 4 characters **(A. flavus** + **Penicillium** sp. + **P. capsici; A. flavus** + **P. capsici; Penicillium** sp. + **P. capsici;** only **P. capsici** as check) with 8 replications and was carried out in pots in greenhouse.

The pots along with the soil were sterilized, at 190°C for two hours in a hot-air oven.

P. capsici cultures were grown on carrot agar medium (75 g carrot, 12 g agar per 1.) at 18°-20°C, in the light, for 10 days. Spore formation of the cultures was examined after this period. The contents of each agar plate was broken down in a mixer, by adding 250 cc tap water for about one minute, to obtain a homogenous suspension, and then, these suspensions were given to the pots. One petri dish inoculum was used for each pot. Subsequently, 250 cc water was added to each pot in order to ensure the mycelial penetration to the soil. The pots were kept in this case for 14 days by watering everyday. This period was satisfactory for colonization of the fungus.

At the end of this colonization period of **P. capsici,** the pots infected by the fungus were divided into four groups, each with 8 pots, and 2 of these groups were infected separately by **A. flavus** and **Penicillium** sp., which had been grown on PDA at 25°C, by the method mentioned above. One groups was infected by both fungi and the other served not treated as check. All the pots were

kept in this condition for 14 days by watering every day. After this period four pepper seedlings were planted in each pot. Reisolations were made from the wilted seedlings.

RESULTS AND DISCUSSION

In vitro Studies: While the growth continued in the petri dishes in which only **P. capsici** was planted as control, the growth of the pathogen was completely stopped due to inhibitory effect of antagonists, on 10th day in case of Penicillium sp. and on 11th day for A. flavus (Fig. 1).

The numerical values of inhibitions for both fungi are given in Table 1.

Table 1. The average colonial diameters (mm) of **P. capsici** in the controls and in the petri dishes with planted together **A. flavus** and **Penicillium** sp., and the ratios of inhibition of the fungi 11 days after planting

The average colonial diameters of **P. capsici** (mm)		
Control	Planted with A. flavus	Planted with Penicillium sp.
66.66	33.14	40.00
Inhibition %	50.28	35.00

It was observed that **Penicillium** sp. inhibited the **P. capsici** in the farther distance than **A. flavus** (Fig. 1). However, the ratios of inhibition on Table 1. shows that **A. flavus** has inhibited the **P. capsici** more than the **Penicillium** sp. It is necessary to explain that these values have been obtained under the certain conditions, whereas the values can vary when conditions change in favour of and contrary to pathogen or antagonists.

In vivo Studies: Just 4 days after planting, the root, crown and stem rots were observed on the seed-

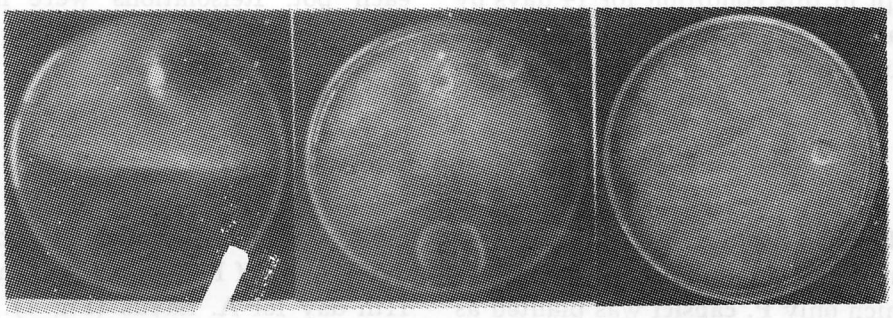

Figure 1. The colonial growths of **P.capsici**
a) in control, b) **Penicillium** sp., c) **A.flavus**

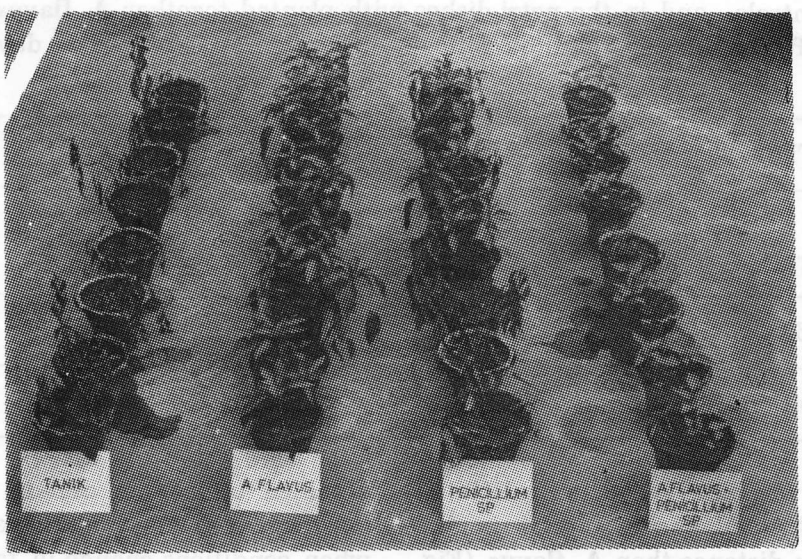

Figure 2. Appearance of the pepper plants in the pots treated with antagonists and with only **P.capsici** as control, 18 days after planting.

lings in the pots which were infected only with **P. capsici** as control and after 17 days all the plants in these pots died. Whereas, the 28.13 % of the plants in the rots which were treated with **Penicillium** and **P. capsici**, and the 56.25 % of those treated with **A. flavus**, **Penicillium** sp. and **P. capsici**, were healthy at the end of the same time. All the plants in the pots treated with **A. flavus** and **P. capsici** were healthy even 30 days after planting (Fig. 2, Table 2).

Table 2. The ratios of disease, and the percentages of effects of the antagonistic fungi on incidence of the disease, 17 and 30 days after planting

	The ratio of disease (%)		The percentages of effects	
CHARACTERS	17 days after	30 days after	17 days after	30 days after
A.flavus + Penicillium sp. + P. capsici	43.75	87.50	56.25	12.50
A.flavus + P.capsici	0.00	0.00	100.00	100.00
Penicillium sp. + P. capsici	71.87	87.50	28.13	12.50
P. capsici (as control)	100.00	100.00	—	—

In vivo studies, only **A. flavus** had an absolute effect on incidence of the disease, while **P. capsici** were inhibited by both fungi in vitro experiments. The effect of **Penicillium** sp. was very low as compered to **A. flavus** in vivo.

30 days after planting the effect of **A. flavus** in the pots which were treated together with **Penicillium** sp. was very low as compered to those treated solely. This was probably because of an interaction between **A. flavus** and **Penicillium** sp. This phe-

nomenon suggests that it is necessary to take into considerations the interactions of soil microorganisms and to use **A. flavus** and others in biological control.

Some problems have appeared to be solved in consequence of this study. Will its antagonistic effect be observed when **A. flavus** was given directly into field soils? What is mechanism of antagonism of A. flavus? Will aflatoxin be a problem in biological control? Studies must be continued to answer all those questions.

ÖZET

ASPERGILLUS FLAVUS LINK. VE BİR **PENICILLIUM** SP.'NİN **PHYTOPHTHORA CAPSICI** LEON.'YE ANTAGONİZMİ ÜZERİNDE **IN VITRO** VE **IN VIVO** ARAŞTIRMALAR

Topraktan izole edilen **A. flavus** ve bir **Penicillium** sp.'nin **Phytophthora capsici** Leon.'ye karşı antagonistik etkileri önce **in vitro** daha sonra **in vivo** koşullarda denendi.

İn vitro çalışmalar laboratuvar koşullarında, petrilerde ve PDA ortamı üzerinde yapılmıştır. Çalışmada **A. flavus**'un engelleme oranı % 50.28 ve Penicillium sp.'nin engelleme oranı ise % 35.00 olarak saptanmıştır.

In vivo çalışmalar serada saksı denemeleri şeklinde yapılmıştır. Çalışmada 4 karakter (**A. flavus** + **Penicillium** sp. + **P.capsici**; **Penicillium** sp. + **P.capsici**; **A.flavus** + **P.capsici** ve sadece **P. capsici** tanık olarak) ve 8 tekrar kullanılmış, her saksıya 4 biber fidesi dikilmiştir. Steril saksılara laboratuvarda yetiştirilen **P. capsici** ve diğer funguslardan birer petri inokulum olarak ilave edilmiş ve ilave edilen funguslar için 14 er gün saksı toprağında kolonizasyon süresi tanınmıştır. Fidelerin dikimin den 17 ve 30 gün sonra yapılan gözlemlerde tanık bitkilerin tamamen solduğu, **A. flavus** ilave edilen saksılardaki tüm fidelerin ise 17 ve 30 uncu günlerde sağlam olduğu görülmüş tür. **Penicillium** sp. ilave edilen **P. capsici** ile bulaşık saksılarda ise 17. günde hastalık oranı % 71.87, 30. gün % 87.50 olarak saptanmıştır. **A.flavus** ve **Penicillium** sp. nin birlikte ilave edildiği bulaşık saksılarda ise 17. gün % 43.75, 30. gün % 87.50 oranında has talık görülmüştür. Solan biber fidelerinden **P. capsici** fungusu reizole edilmiştir.

Bu çalışmanın sonunda **A. flavus**'un **P. capsici**'ye karşı mutlak bir etkisi görülmekle beraber **Penicillium** sp. ile interaksiyonu düşündürücü olmuştur. Şimdilik **A. flavus**'un antagonistik etki mekanizmasının ne olduğu, **A. flavus** direkt olarak tarla topraklarına verildiğinde antagonistik etkinin gözlenip gözlenemeyeceği Aflatoksin'in biyolojik bir savaş için sorun teşkil edip edemeyeceği soruları çözüm beklemekte olup çalışmalara devam edilmektedir.

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New Recoad

The First Report of Cristacortis Virus on Bodrum Common Mandarin In Turkey

Turhan AZERİ

Regional Plant Protection Research Institute Bornova, İzmir, TURKEY

In 1978, typical stem pitting symptoms of Cristacortis virus resembling those of Psorosis concave gum were found in Bodrum common mandarins (**Citrus reticulata** Blanco) buded on sour orange (**C. aurantium** L.) rootstocks in İzmir region.

SYMPTOMS. —— The symptoms of Cristacortis virus on common mandarin trung beded on sour orange rootstock are shown in Figure 1. The depressions and stem pittings were found on the trunk, the main limbs and the secondary branches of the mandarin scion (Fig. 1 A).

After removal of the mandarin bark, several Pits were found on the wood (Fig 1 A,C) and the pegs on the cambial side of the bark as shown in Fig. 1. B. The pegs often present several peaks as reported by Vogel and Bové (1968). Gum-like material was found in the bottom of the pits. Because of the pits, the trunk and the main branches of mandarins were depressed. According our field observations on Cristacortis, 20 % percent of the common mandarin trees were infected with this virus.

Cristacortis virus was first described by Vogel and Bové (in 1964) in Tarocca sweet orange trees in Corsica. Later the precence of this virus were reported from Sardinia (Servazzi et al., 1968) and Italy (Martino et al., 1972). Typical symptoms of Cristacortis have been observed also in Sicilya, Spain, Morocco and Algeria (Vogel and Bové, 1792). The same authors found that Cristacortis virus is different from tristeza, exocortis, cachexia and Concave-gum viruses. Cristacortis can be significantly af-

fective and decrease yield and quality of fruit as well as tree size (circumference) as reported by Martino et al (1972).

Further, it is necessary to study on the presence of cristacortis on several citrus species and varieties in our Citrus growing areas.

ÖZET

TÜRKİYEDE BODRUM YERLİ MANDARİNLERİNDE CRISTACORTIS VİRUSUNA AİT İLK RAPOR

1978 Yılında, İzmir Merkez ilçeye bağlı Gümüşsu turunçgil üretim yöresinde yapılan simptomatolojik gözlemlerde, turunç anacı üzerine aşılı Bodrum çekirdekli mandarinlerinde Cristacortis virusunun tipik çukurlaşma belirtileri saptanmıştır.

Yapılan simptomatolojik gözlemlerde, Bodrum mandarinlerinin aşı yeri üstündeki ana gövdeleri üzerinde, ağacın birinci ve ikinci derecedeki dalları üzerinde ayni gövde çukurlaşmaları ve gövde yassılaşma belirtileri görülmüştür. Mandarin gövdesinden kabuk kesidi çıkarıldığında, gövdedeki çukurlukların odun yüzeyindeki dip kısımlarında zamk bulunan girintiler ile, kabuğun alt yüzeyinde kambiuma ait Cristacortisin tipik belirtisi olan çıkıntılara rastlanmıştır. Bu belirtilerin Gözenek (xyloporosis) virusunun belirtilerinden farklı olduğu görülmüştür.

Yapılan incelemelerde, Cristacortis'in Bodrum mandarinlerinde % 20 oranında yaygın olduğu ve ağaçların ana gövdesi ile dallarda gelişme durgunluğu ve şiddetli gövde çukurlaşma belirtileri nedeniyle gövde ve dal larda zayıf basık ve yassı gelişme izlenmiştir.

Turunçgillerde, gelişme durgunluğu meydana getiren bu virusun, Turunçgil bölgelerimizdeki diğer turunçgil çeşitlerindeki durumunu araş tırmanın faydalı olacağı kanısındayım.

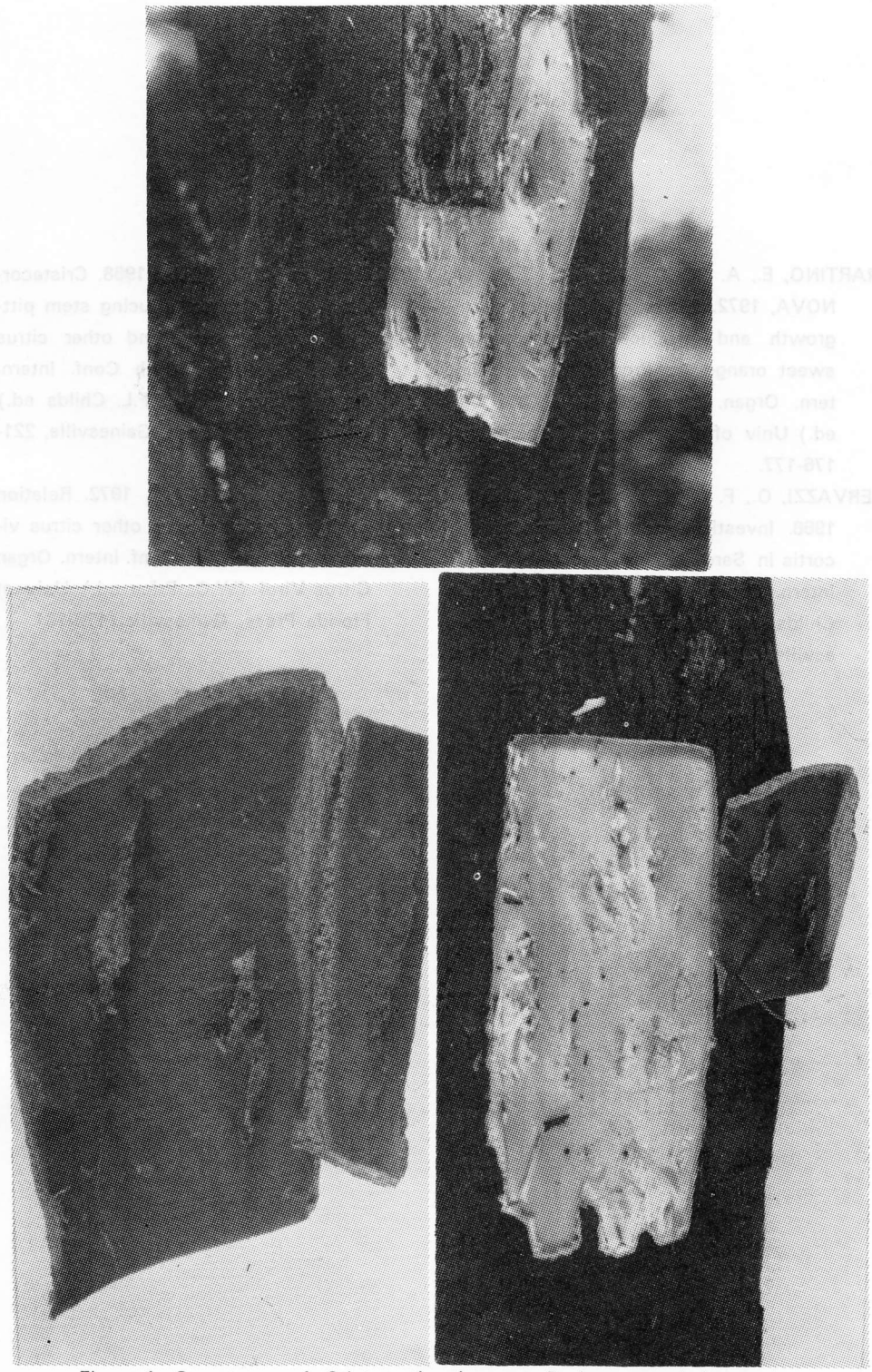

Figure 1. Symptoms of Cristacortis virus on Bodrum mandarin trunk.
A—Depression stem pittings on mandarin trunk and pits in the wood
B—Pegs from the cambial side of the trunk bark.
C—Pits in the wood of the mandarin branch.

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