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CONTENTS

Untersuchungen uber die Biologie und Physiologische Variation von auf Mittelanatolischen Gersten Vorkommenden **Drechslera sorokiniana** (Sacc.) Subram and Jain und die Reaktion der Befallenen Gerstensorten auf den Parasiten.
H. AKTAŞ und T. BORA 1

Physiological Studies of **Alternaria helianthi** (Hansf.) Tubaki and Nishihara the Incitant of Leaf Blight of Sunflower (**Helianthus annuus** L.)
P.C. REDDY and B.M. GUPTA 25

Decline of Satsuma Mandarin Orange in Turkey.
T. AZERİ 37

Heterodera fici Kirjanova 1954 in Aegean Region.
H.Ş. YÜKSEL 45

Determinations of Fungal Diseases on the Commercially Grown Ornamental Plants in Aegean Region.
E. SEZGİN, A. KARCILIOĞLU, M. ESENTEPE and E. ONAN 53

Doğruluk Matbaacılık ve Tic. Koll. Şti. — İZMİR

J. Turkish Phytopath., Vol. 10, Num. 1, 1-24, 1981

Untersuchungen uber die Biologie und Physiologische Variation von auf Mittelanatolischen Gersten Vorkommenden **Drechslera sorokiniana** (Sacc.) Subram. and Jain und die Reaktion der Befallenen Gerstensorten auf den Parasiten

Hüseyin AKTAŞ[1] und Tayyar BORA[2]

ZUSAMMENFASSUNG

Durch diese Arbeit konnten die Biologie und die physiologische Variation von **D. sorokiniana** (Sacc.) Subram. and Jain festgestellt werden. Darüberhinaus wurden die Reaktionen der Gerstensorten und-linien gegenüber diesem Erreger untersucht. Nach 322 Tagen Beobachtung zur Untersuchung der Überwinterung des Erregers wurde festgestellt, dass der Erreger auf infiziertem Stoppelfeld sowohl auf den Wurzeln und Wurzelhalmen als Konidien oder Myzel als auoh im Boden als Konidien 100 % lebendig überwintern konnte. Bei den physiologischen Variationsuntersuchungen des Pathogens wurden 69 Isolate sieben Tage lang auf PDA—, HEA— und MEA— Naehrböden bei 20°C, 25°C und 30° kultiviert. Die Ergebnisse wurden statistisch ausgewertet und bei 18 Isolaten zeigten sich Unterschiede. Die Prüfung auf Pathogenitaet hat ergeben, dass die 18 Isolate von **D. sorokiniana** neun unterschiedliche Virulenzen aufweisen. Die Reaktionen der 45 verschiedenen Gerstensorten und-linien, die in der Türkei angebaut werden, wurden gegenüber der virulenteren Rasse S 96 von **D. sorokiniana** getestet.

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EINLEITUNG

In Anbetracht der Klimabedingungen, Bodenbeschaffenheit und der topographischen Eigenschaften der Region kommt dam Getreideanbau im Mittelanatolien eine zentrale Bedeutung zu. So macht die Anbauflaeche der Gerste in der Region 44.2 % der Gesamtanbauflaeche der Türkei aus und die Region liefert 45.7 % der Gesamtproduktion (Devlet İstatistik Enst., 1974-1976). In der Türkei sind die festen Grenzen der Anbauflaeche schon erreicht. Da die Anbauflaeche also nicht mehr erweitert werden kann, müssen wir uns als Ziel setzen, das Ertragspotential je Flaecheneinheit zu steigern und diesbezügliche Massnahmen sofort zu ergreifen.

Ausserdem ist Gerste für die Rohstoff Industrie und als Exportgut von grosser Bedeutung. In dieser Region, die etwa die Haelfte der Gesamtanbauflaeche und der Gesamptproduktion ausmacht (Tosun, 1968; Gökçora, 1969), stellt **D. sorokiniana** neben verschiedenen, den Ertrag gefaehrdenden Krankheiten, auch ein ernsthaftes Problem dar (Abb. 1,2). So tritt die Blattfleckenkrankheit der Gerste fast jedes Jahr überall auf Gerstenanbauflaechen der Welt auf und ruft erhebliche Ertragsverluste hervor (Christensen, 1922; Mitra, 1930; Simaro et Ludwig, 1950; Reed, 1952, Oswald, 1953; Spurr and Kiesling, 1961; Iren, 1962; Csuti, 1965; Karaca, 1968; Clark and Wallen, 1969; Lange de la Camp, 1971; Piening et al., 1977; Whittle and Richardson, 1978). **D. sorokiniana** ist wichtiger Fusskrankheitserreger an Weizen, an Gerste sowie an anderen Gramineen und einigen Dikothylenpflanzen (Christensen, 1922; Mitra, 1930; Butler and Jones, 1949; V-Bourgin, 1949; Sprague, 1950; Dickson, 1956; Kost'al, 1961; Spurr and Kiesling, 1961; Seidal, 1970; Ellis, 1971; Chidambarem et al., 1973).

D. sorokiniana laesst sich in der Türkei besonders auf Gerste beobachten und veranlasst in verstaerktem Masse Beschwerden der Produzenten. In der Region bewirkt der Erreger einen Ertragsverlust in Höhe von 121 kg/ha. Unter Berücksichtigung der Gasamtanbauflaeche der Region summiert sich der Produktionsverlust auf 133 Tausend Tonnen, was einer Geldeinbusse in Höhe von 1.197 Milliarden T.L. entspricht. Es können zwar bestimmte chemische Bekaempfungsmittel gegen den Erreger eingesetzt werden und es gibt in der Tat effektive Fungizide (Reed, 1952; Machacek, 1954; Kostaal, 1961; Mills, 1969; Saur, 1967). Aber die Anwendung solcher chemischer Bekaempfungsmittel bringt be-

kanntlich ernsthafte Probleme mit sich. Um solche Probleme zu beseitigen, muss allem die Reaktion der verschiedenen Gerstensorten undlinien gegenüber dem Krankheitserreger festgestellt werden. Dazu ist erforderlich, die Biologie und physiologische Variation des Pathogens eingehend zu studieren.

MATERIAL UND METHODEN

Im Gebiet Mittelanatolien wurden aus kranken Gerstenpflanzen Proben gesammelt und daraus 163 Isolaten von **D. sorokiniana** entnommen. Pilzkulter erfolgte auf PDA—, HEA und MEA Nanrböden. Es wurden an der Gerstensorte Tokak 157/37 Blatt-Saatgut-und Bodeninokulationen vorgennommen. Die Prüfung auf Pathogenitaet erfolgte an 4 Gerstensorten, die unterschiedliche Reaktionen auf Fungus zeigten. Zwei von diesen Gerstensorten, Dekap und Manchuria, sind resistente Sorten und Gateway ist eine anfaellige Sorte nach Scharen[1]. Die vierte Sorte ist in diesem Anbaugebiet die meist angebaute Sorte Tokak 157/37. Zur Erfassung der Reaktionstypen wurden die in der Türkei angebauthen oder aussichtsreichen 45 Gerstensorten undlinien herangezogen.

Im Gebiet Mittelanatolien wurde von Gerstenpflanzen je 500 ha eine Gerstenprobe entnommen (Bora ve Karaca, 1970). Auf diese Weise wurden 163 Isolaten von **D. sorokiniana** gewonnen.

Die Feststellung der Biologie von **D. sorokiniana** wurde im Freiland und im Institutsgarten durchgeführt. Dabei wurde fest gestellt, dass **D. sorokiniana** auf infizierten Pflanzenrückstaenden im Freiland und in 10 cm Tiefe im Boden überwintert. Hierzu wurden Wurzel— oder Wurzhelhalmproben von etwa 2 cm Länge mit einer 1 % iger Chlorlauge (Na-Hypochlorit = NaO C1) 2-3 Minuten oberflaechlich sterilisiert (Spurr and Kiesling, 1961; Clark and Wallen, 1969; Jorgensen, 1974). Diese Vorbildung wurde in der Feuchtkammer bei 22 + 2°C und 4 oder 5 Tage inkubiert (Jorgensen, 1974). Die Konidien im Boden wurden nach Ledingham und Chinn (1956) aufgenommen. Danach wurde diese Vorbildung im PDA-Naehrboden bei 22 + 2°C, 24 Stunden lang inkubiert und es wurde beobachtet, ob eine Konidienkeimung stattgefunden hat (Meronuck and Papper, 1968).

Bei der Feststellung der Belichtungseinwirkung auf das Wachstum des Pathogens auf PDA-Medium bei 25°C, wurden fünf verschiedene Belichtungsperioden untensucht. Der Versuch wurde in fünf Wiederholungen durchgeführt.

1) 24 Std. Belichtung/Tag
2) 24 Std. Dunkelheit/Tag
3) 8 Std. Belichtung + 16 Std. Dunkelheit/Tag
4) 12 Std. Belichtung + 12 Std. Dunkelheit/Tag
5) 16 Std. Belichtung + 8 Std. Dunkelheit/Tag

Die Blattinokulation erfolgte im 3— Blattstadium der Gerste. (Timian, 1959; Saur, 1976). Für die Inokulation wurden die Sporenkonzentrationen 10^4, $3x10^4$, 10^5, $2x10^5$ und $2{,}7x10^5$ Konidien/ml hergestellt. Ver Versuch wurde in 5 Wiederholungen durchgeführt. Je 10 Gerstenpflanzen/Topf erhielten etwa 1 ml Sporensuspension, dadurch wurde eine gleichmaessige Benetzung der Gerstenpflanzen erreicht. Die Töpfe wurden 48 Stunden lang unter Polyäthylenbeutel bei ca. 100 % relativer Luftfeuchtigkeit gehalten. (Mitra, 1930; Rosen, 1954; Timian, 1959; Spurr and Kiesling, 1961; Cook and Timian, 1962; Mumford, 1966; Banttari et al., 1975). Die Pflanzen wurden acht Tage nach der Inokulation bonitiert (Spurr and Kiesling, 1961; Mumford, 1966; Lange de la Camp, 1967; Hagen and Larsen, 1979). Zur Bonitur wurde die folgende Skala benutzt.

Skala	Prozentuale Befallsfäche	Reaktionstypen
0	0 (Gesund)	I (Ummun)
1	10 (Wenig)	R (Resistent)
2	25 (Mittel)	MR (Maessig Resistent)
3	40 (Hoch)	MS (Meassig Anfaellig)
4	60 (Stark)	M (Anfaellig)
5	80 (Sehr Stark)	WS (Hoch Anfaellig)

Der prozentuale Blattbefall je Topf wurde nach acht Tagen wie folgt errechnet (Saur, 1976).

$$\text{Prozentualer Blattbefall (Krankheitserscheinung) Je Topf} = \frac{\text{Summe der prozentualen Befallsfleachen der Einzelblaetter Je Topf}}{\text{Gesamtzahl der Blaetter Je Topf}}$$

Bei den Boden— und Sameninokulationen wurden acht unterschiedliche Methoden geprüft. Der Versuch wurde in fünf Wiederholungen durchgeführt.

1) Samen-Inokulationen
2) Samenkeimlinge in Kulturen
3) Getrennte Pflanzen-Inokulationen
4) Gesamte Pflanzen-Inokulationen
5) Kultur-Inokulationen
6) Stroh-Inokulationen
7) Inokulationen mit befallenem Gerstenpflanzenmaterial

1) Scharen, A.L. Montona Univ. Dept. of Plant Pathology USA.

8) Saat-Inokulationen

Bei den Boden— und Saatgutinokulationen wurde 30 Tage nach Inokulation bonitiert. Hierzu wurde folgende Skala gebraucht. (Sa, ur, 1976).

Skala	Symptome
0	Gesund
1	Schwache Braenung (nur Coleoptile)
3	Mittlere Braeunung (Blattscheide gebraeunt)
5	Starke Braeunung (Coleoptil und Blattscheide gebraeunt und Blattflecken)
7	Abgestorben

An den ausgewählten Isolaten wurde physiologische Variation im Klimaschrank (Fa. Köttermann) in fünf Wiederholungen untersucht. Die Isolate wurden bei 25°C auf PDA-Naehrboden kultiviert (Mitra, 1930; Andersen, 1952; Clark and Dickson, 1956; Spurr and Kiesling, 1961; Morton, 1962; Wood, 1962; Saur, 1976; Hagan and Larsen, 1979). Je Petrischale wurde 20 ml PDA-Medium ausgegossen. Im Klimaschrank wurden sie 7 Tage bei 25°C inkubiert. Dabei wurden die durchschnittliche taegliche Wachstumsrate, die Myzelwachstumsform sowie die Kolonienfarbe festgestellt. Hierzu wurden 163 Isolate von **D. sorokiniana** bonietiert und nach statistischer Auswertung zeigten 69 Isolate Unterschiede.

Bei den physiologischen Variationsuntersuchungen wurden 69 Isolate von **D. sorokiniana** 7 Tage lang im Klimaschrank auf PDA—, HEA— und MEA— Naehrboden bei 20°C 25°C und 30°C Kultiviert. Dabei wurde die durchschnittliche Wachstumsrate pro Tag, die Myzelwachstumsformen, die Kolonienfarbe und die durchschnittliche Konidiendichte der Isolaten untersucht. Die Sparenkonzentrationen wurde im 10^{-3} sporensuspension gezaehlt (Mumford, 1966)

Die Untersuchungen zur Prüfung der Pathogenitaet wurden mit 18 Isolaten, an 4 Gerstensorten (Dekap, Manchuria, Gateway und Tokak 157/37), die unterschiedliche Reaktion auf Funges zeigten, durchgeführt. Hierzu wurde eine Dichte von 10^5 Konidien/ml hergestellt (Saur, 1976). (Je 40 ml Sporensuspension wurde 1 Trophen Tween-80 zugegeben (Timian, 1959; Yeğen, 1976).

ERGEBNISSE UND DISKUSSION

1. Die Uberwinterung des Pathogens

Es wurde die überwinterung von **D. sorokiniana** als Myzel und als Konidium studiert. Es wurden dabei sowohl im Freiland als auch im Institutsgarten ab 5.10.1978 zu unterschiedlichen Zeiten Proben entnommen (Tab. 1) Im Rahmen eines 322 tägigen Beobachtungszeitraumes wurde festgestellt, dass der Fungus in infiziertem Stoppelfeld sowohl an den Wurzeln und Wurzelhalden als Konidien oder Myzel (Abb. 5) als auch im Boden als Konidien (100 % lebendig) überwintert. Dieses Ergebnis stimunt überein mit denen von Christensen (1922), Dickson (1956), Müller (1958), Kos'al (1960), Ammon (1963), Chinn and Tinline (1964), Karaca (1968), Meronuck and Pepper (1968), Seidel (1970) und oJrgensen (1974). Der Pathogen bleibt auf infizierten Pflanzenrückstaenden in 10 cm Tiefe 6 bis 7 Monate 100 % lebendig. Erst nach 9 bis 10 Monaten unter gleichen Bedingungen setzt sich die Vitalitaet des Pathogens auf 40 % herab.

Die Konidien von **D. sorokiniana** überleben den Winter im Boden vollstaendig. Aber wenn die Inkubationszeit verlaengert wird, so verringert sich die Konidienpopulation in normalem Boden im Gegensatz zum sterilen Boden (Chinn and Ledingham, 1958; Boosalis, 1960 a, b und 1962). Zieht man die Vielzahl der Antagonisten des Parasiten in Betracht, so dürfte die Verringerung der Konidienpopulation in normalem Boden verstaendlich sein. Dieses Ergebnis stimut überein mit denen von Campbell (1958), Chinn and Tinline (1964), Boosalis (1965) und Nair (1968).

Zum Schluss kann gesagt werden, dass der Pathogen auf dem infizierten Stoppel als Konidien und Myzel und im Boden als Konidien 100 % lebendig über wintert, so dass er staendig imstande ist, neue Wirtspflanzen zu infizieren und auf bereits infizierten Felder seine Vitalitaet weitgehend aufrechtzuerhalten.

2. Die Feststellung der Optimalen Belichtungsdauer von **D. sorokiniana**

Bei der Feststellung der Belichtungsdauer wurden die folgenden Alternativen herangezogen; Dauerlicht, Dauerdunkel, 8 Std. Licht + 16 Std. Dunkel, 12 Std. Licht + 12 Std. Dunkel, 16 Std. Licht + 8 Std. Dunkel. In diesen Belichtungsalternativen wurde **D. sorokiniana** in PDA-Medium bei 25°C auf seine durchschnittliche Wachstumsrate pro Tag, Sporenkonzentrationen, Konidiengrösse und auf die Anzahl der Septa hin untersucht. Dabei stellte sich heraus, dass die Belichtungsdauer von 12 Std. Lich + 12 Std. Dunkel die günstigste Kombination darstellt. Die Ergebnisse sind aus den Tab. 2,3 und au Abb. 6 zu entnehmen.

Tabella 1. Myzelwachstum von **D. sorokiniana** an den befallenen Gerstenpflanzen und Keimung der Konidien in Boden.

Vorbildungsdatum.	Inkubations periode (Tag)	Myzelwachstum (%				Konidienkeimlinge					
		Bei der Vorbildung im Freiland		Bei der Volbildung im Institut Garben		In Normalem Boden		In Sterilem Boden			
		Normal liegendes Gerstenpflanzenmaterial	10 cm tief im Boden liegendes Gerstenpflanzenmaterial	Normal liegendes Gerstenpflanzenmaterial	10 cm tief im Boden liegendes Gerstenpflanzenmaterial	Zahl der gesamten Keimlinge	Zahl der gesamten Nicht-Keimlinge	Prozentsatz der Keimlinge	Zahl der gesamten Keimlinge	Zahl der gesamten Nicht-Keimlinge	Prozentsatz der Keimlinge
12.7.1978	0										
5.10.1978	83	100	100	100	100	362	—	100	387	—	100
28.11.1978	136	100	100	100	100	363	—	100	391	—	100
14.12.1978	152	Nicht Vorbildung	Nicht Vorbuldung	100	100	357	—	100	401	—	100
2.1.1979	170	Nicht Vorbildung	Nicht Vorbildung	100	100	255	—	100	295	—	100
16.2.1979	214	100	100	100	100	310	—	100	389	—	100
5.3.1979	233	Nicht Vorbildung	Nicht Vorbildung	100	40.0	357	—	100	369	—	100
9.4.1979	267	100	60,0	100	60,0	337	—	100	375	—	100
27.4.1979	285	100	40,0	100	40,0	312	—	100	361	—	100
14.5.1979	302	100	—	100	40,0	311	—	100	376	—	100
4.6.1979	322	100	—	100	40,0	331	—	100	399	—	100
14.11.1979	487					299	5	98.3	391	6	98,4
14.11.1980	852					120	35	77,4	191	54	77,9

Tabelle 2. Einwirkung von Belichtungsalternativen, in PDA—Naehrboden 25°C auf die durchschnittliche Wachstumsrate von **D. sorokiniana**

	Belichtungsdauer				
Tage	Dauerlicht	Dauerdunkel	8 Std. Licht + 16 Std. Dunkel	12 Std. Licht + 12 Std. Dunkel	16 Std. Licht + 8 Std. Dunkel
1	15.0	16.2	12.4	18.6	14.2
2	25.4	28.8	22.4	33.0	24.4
3	30.0	35.0	32.0	45.2	33.6
4	41.8	45.0	42.8	58.2	42.4
5	55.4	50.0	56.0	71.0	48.0
6	61.2	55.0	65.4	78.4	54.2
7	64.0	58.6	76.1	84.2	59.6
8	66.0	60.8	76.0	86.8	60.6

Tabelle 3. Einwirkung unterschedlicher Belichtungsdaurer auf die durchschnittliche Wachstumsrate pro Tag, Sporenkonzentrationen, Konidiengrösse und auf die Anzahl der Septa von **D. sorokiniana** in PDA Naehrboden bei 25°C

Belichtungsdauer	Durchschnittliche Wachstumsrate Pro Tag (mm)	Sporenkonzentrationen Konidien 10^4/ml	Konidiengrösse (u)	Anzahl der Septa von Konidien
Dauerlicht	6.76	10.34	49.79 x 20.46	3.74
Daurdunkel	5.33	17.40	38.03 x 18.82	3.08
8 Etd. Licht + 16 Std. Dunkel	8.93	22.54	49.79 x 21.09	3.94
12 Std. Licht + 12 Std. Dunkel	8.96	23.06	53.87 x 22.19	4.48
16 Std. Licht + 8 Std. Dunkel	6.03	11.48	48.93 x 21.09	3.84

DRECHSLERA SOROKINIANA

Mit Hilfe von Blattinokulationen wurde der Einfluss der Inokulumdichte auf den Befal und die Inkubationsdauer festgestellt. Dabei wurde mit sechs verschiedenen Inokulationsdichten gearbeitet, die zwischen 10^4 und 2,7 x 10^5 Konidien/ ml variierten (Tab. 4). Die Zunahme der Inokulumdichte von 10^4 Konidien/ml um das bis 5-fache bewirkte eine Zunahme der Krankheit. Die empfindlichen Gerstenpflanzen können aber die Resistenz vortäuschen, wenn die empfindliche Reaktion derselben Pflanzen deutlich. Wenn die Inokulumdichte 10^5 Konidien/ml betraegt oder das 2-bis, 2,7-fache derselben, so lassen sich bei dem prozentualen Blattbefall merken. Nach einer bestimmten Inokulumdichte laesst sich der prozentuale, Blattbefall aber nicht mehr aendern (Abb. 7).

Es wurde weiterhin festgestellt, dass eine 48-stündige Inkubationsdauer bei der Blattinokulation ausreichend ist. Ausserdem ergibt sich die Notwendigkeit, dass die Auswertung 8 bis 10 Tage nach der Inokulation erfolgen muss. Dieses Ergebnis stimmt überein wit denen von Mitra (1930), Rosen (1954), Timian (1959), Spurr and Kiesling (1961) (Cook and Timian (1962), Mamford (1966) und Banttari et al (1975).

Bei allen acht unterschiedlichen Inokulationsmethoden des Bodens und der Samen kontte **D. sorokiniana** Krankheit induzieren. So ist auch nach Oswald (1953) der Fungus primärer Pathogen. Jedoch ist die Faehigkeit zur Krankheitsbildung von der Inokulumdichte der betreffenden Methode abhaengig (Tab. 5). Diese Arbeit hat uns gezeigt, dass die Verbreitung des Fungus, mit den Samen, mit dem Boden und mit den befallenen Pflanzen stattindet. Christensen (1922), Simard und Ludwig (1950), Müller (1958), Kost'al (1961), Ammon (1963), Karaca (1968), Clark and Wallen (1969), Seidel (1970), Jorgensen (1974) und Whittle and Richardson (1978).

Tabelle 4. Einwirkung vor 6 unterschiedlichen Inokulumdichten auf den prozentsatz der befallenen Blätter und auf den prozentualen Blattbefall

Inokulum-dichte Konidien/ml	Zahl der Inokulierten Blätter Wiederholungen					Zahl der befallenen Blätter Wiederholungen					Zahl der befallenen Blätter in Prozent	Prozentualer Blattbefall Wiederholungen (x)					x
	1	2	3	4	5	1	2	3	4	5		1	2	3	4	5	
10^4	30	30	30	30	30	12	14	17	20	18	50	10.33	11.83	12.00	11.33	13.50	11.79
$3x10^4$	30	30	30	30	30	22	26	30	24	27	86	29.00	24.33	25.33	26.33	22.66	25.53
$5x10^4$	30	30	30	30	30	30	30	30	30	30	100	33.00	33.50	35.00	33.00	46.50	36.20
10^5	30	30	30	30	30	30	30	30	30	30	100	75.66	74.33	74.50	77.16	80.00	76.33
$2x10^5$	30	30	30	30	30	30	30	30	30	30	100	77.00	77.16	75.33	78.66	77.66	77.16
$2,7x10^5$	30	30	30	30	30	30	30	30	30	30	100	76.83	77.83	77.83	76.33	77.66	77.29
Kontrolle	30	30	30	30	30	0	0	0	0	0	0						

DRECHSLERA SOROKINIANA

Tabelle 5. Durchschnittlicher prozentualer Blattbefall bei unterschiedlichen Methoden zur Boden- und Sameninokulationen mit **D. sorokiniana**

Inokulationsmethoden	Durchschnittliche Prozentuale Krankheitserscheinung (%)	Duncan Test	Gruppen
Sameninokulationen	60.56	A	3
Samenkeimlinge im Kulturen	69.99	AB	
Getrennte pflanzen Inok.	33.13	AB	5
Gesamte pflanzen Inok.	29.42	B	
Kulturinokultionen	76.56	C	1
Strohinokulationen	74.56	CD	2
Mit befallenem Gerstenpflanzenmaterial Inok.	22.56	CD	6
Sandinokulationen	37.71	D	4

3. Untersuchung In Vitro

Im Untersuchungs gebiet Mittelanatolien wurden Gerstenproben entnommen aus denen 163 Isolate von **D. sorokiniana** hergestellt worden sind. Diese Isolate wurden bei 25°C auf PDA-Naehrboden auf ihre durchschnittliche Wachstumsrate pro Tag, Myzelentwicklung undform und Kolonienfarbe hin geprüft. Zum Schluss wurden 69 Isolate ausgewaehlt und damit begonnen, die physiologische Variation in-vitro zu studieren. Zur Festsellung der physiologischen Variation wurden 69 Isolate auf PDA-, HEA-und MEA-Medien bei 20°C, 25°C und 30°C sieben lange kultiviert. Debei wurde die durchschnittliche Wachstumsrate pro Tag, Myzelwachstumsformen, Konidienfarbe und durchschnittliche Konidiendichte untersuchte. Die statistische Auswertung des Zahlenmaterials hat ergeben, dass 18 Isolate unterschiedliche physiologische Variation aufwiesen.

4. Untersuchung In Vivo

Die Untersuchungen zur Prüfung der Pathogenitaet wurden an 18 ausgewählten und an vier Gerstensorten, die unterschiedliche Reaktion auf Fungur zeigten, durchgeführt. Zwei von diesen Gerstensorten, naehmlich Dekap und Manchuria, sind resistente Sorten und Gateway ist eine anfaellige Sorte. Die vierte Sorte ist im Untersuchungs-

gebiet die meist angebaute Sorte Tokak 157/37.

Die Prüfung auf Pathogenitaet hat ergeben, dass die 18 Isolate höchst virulenten Isolate sind, die im Hinblick auf Kultur Eigenschaftenrundliche Kolonien entwickeln. Darauf folgen diejenigen, die segmentale Kolonien besitzen. Als Ergebnis dieser Arbeit hat sich herausgestellt, dass der Erreger von Blattfleckenkrankheit der Gerste, **D. sorokiniana**, in Gerstenanbaugebieten von Zentralatolien verschiedene physiologische Rassen hat, die acht unterschiedliche Virulenzen aufweisen. In bezug auf Kultureigenschaften ist das Isolat Nummer 52 ein rundliches Myzel entwickelndes Isolat. Diese Rassen wurden nach ihren Virulenzen-angefangen von der hâchst Virulenten-wie folgt numeriert: S 96, S 88, S 101, S 148, S 51, S 132, S 52, S 62 und S 144 (Abb. 8).

Zur Erfassung der Reaktionstypen wurden die in der Türkei angebauten oder aussichtsreichen 45 Gerstensorten und-linien herangezogen. Um den Reaktionsmodus dieser Gerstensorten und-linien festzustellen, wurde die Rasse mit der höchsten Virulenz, Rasse S 96, eingesetzt. Dabei wurden 28 Sorten als hochanfaellig, 14 Sorten als anfaellig, 2 Sorten als maessig anfaellig und 1 Sorte als maessig presistent ermittelt (Tab. 6).

Tabelle 6. Die Reaktionen von in der Türkei angebauten oder aussischtsreichen Gerstensorten und-Linien gegen S 96 Rasse von **D. sorokiniana**

Gerstensorten und Gerstenlinien	Reaktionstypen					
	I	R	MR	MS	S	VS
Tokak 157/37						+
Cumhuriyet 50						+
Zafer 160					+	
Yeşilköy 387					+	
Yerçil 147						+
69147					+	
814—ZS—1						
P17—27						+
Gem						+
Kaya						+
AL						+

DRECHSLERA SOROKINIANA

IN				+
KU				+
TY—8				+
TY—10			+	
TY—12				+
TY—14				+
TY—15			+	
TY—16			+	
TY—21		+		
TY			+	
Kavak 7531			+	
Kılıç 9602		+		
69 H 2072			+	
66 H 12	+			
79 H 101				+
79 H 102				+
6744				+
7113			+	
1552			+	
1553			+	
1557			+	
1558			+	
1564				+
1602				+
1604				+
1606				+
1611				+
1619				+
I—5				+
I—8				+
I—9				+
I—12				+
A—9				+
A—10				+
Gesamt	1	12	14	28

Ö Z E T

ORTA ANADOLU ARPALARINDA **Drechslera sorokiniana** (Sacc.) Subram and Jain'in BİYOLOJİSİ, FİZYOLOJİK VARYASYONU VE ARPA ÇEŞİTLERİNİN REAKSİYONLARI ÜZERİNDE ARAŞTIRMA

Bu çalışma ile patojenin biyolojisi, fizyolojik varyasyonu ve arpa çeşitlerinin reaksiyonları saptanmıştır. Fungusun kışlamasına ilişkin 322 günlük bir çalışmada, gerek anız konumundaki enfekteli arpa bitkisi artıklarının kök ve kök boğazında konidi ve misel olarak, gerekse toprakta konidi olarak kışı % 100 canlı geçirdiği saptanmıştır. Fizyolojik varyasyonun saptanması çalışmaları 69 izolatın PDA, HEA ve MEA ortamlarında 20°C, 25°C ve 30°C sıcaklıkta, 7 günlük geliştirme esasına göre yürütülmüştür. Sayısal veriler istatistik yönden değerlendirilmiş ve 18 izolatın farklı fizyolojik varyasyon oluşturdukları görülmüştür.

Patojenisite testi sonucunda **D. sorokiniana**'nın 18 izolatı 8 farklı virulens oluşturmuş fakat bir izolatın in-vitro özellikler yönünden gösterdiği ayrıcalığı nedeniyle fizyolojik ırk sayısı 9 olarak saptanmıştır.

Çeşit reaksiyon çalışmalarında ise kullanılan 45 arpa çeşit ve hattının, **D. sorokiniana**'nın S 96 numaralı fizyolojik ırkına karşı, 28'i çok duyarlı, 14'ü duyarlı, 2'si orta duyarlı ve 1'i ise orta derecede dayanıklı reaksiyon gösterdikleri saptanmıştır.

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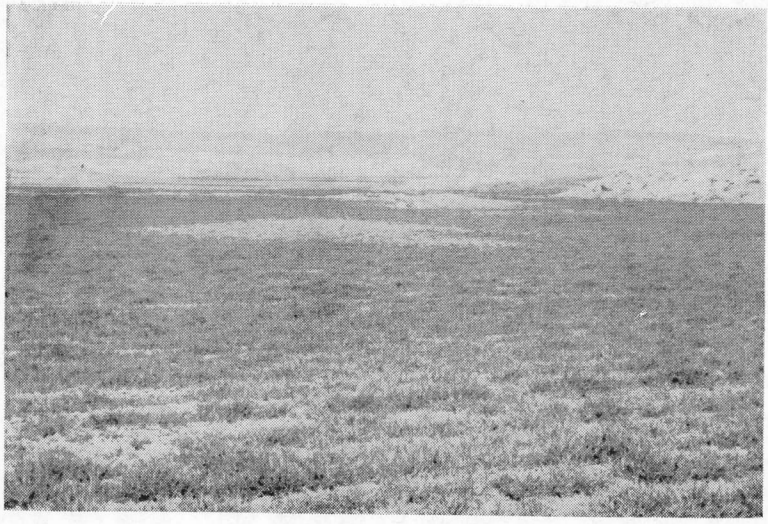

Abb. 1. Durch **D. sorokiniana** befallenes Gerstenfield mit stellenweise auftretenden chlorotischen Pflanzen

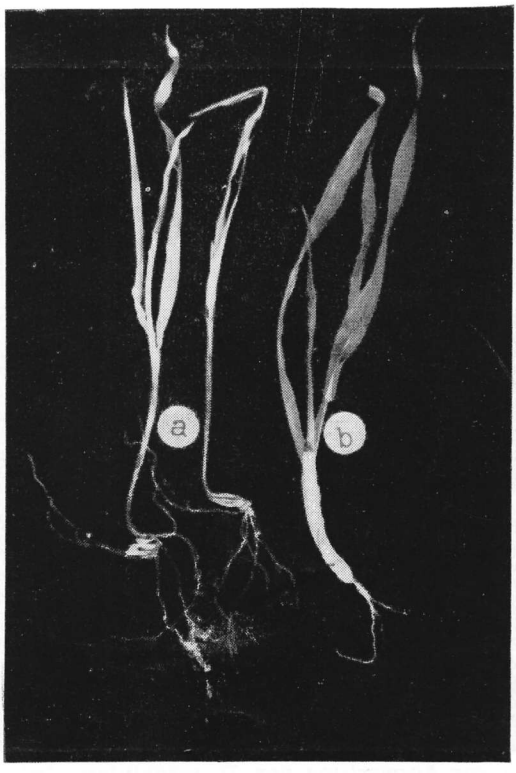

Abb. 2. Mit **D. sorokiniana** befallene (a) und gesunde (b) Gerstenpflanze.

Abb. 3. Skala zur Auswertung von **D. sorokiniana** bei Blattinokulation.

Abb. 4. Skala zur Auswertung von **D. sorokiniana** bei Samen-und Bodeninkulation.

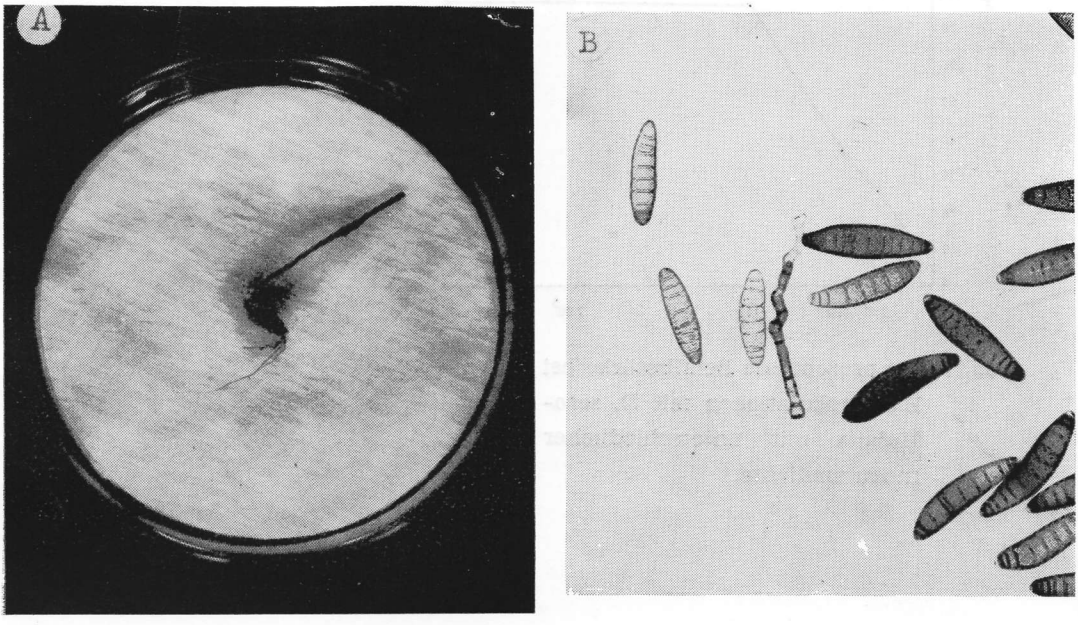

Abb. 5. A) Myzelwachstum von **D. sorokiniana** and der Wurzel und am Wurzelhalm von Gerstenpflanzen-Rückständen in der Feuchtkammer.

B) Konidiophore und Konidien von **D. sorokiniana** unter gleichen Bedingungen.

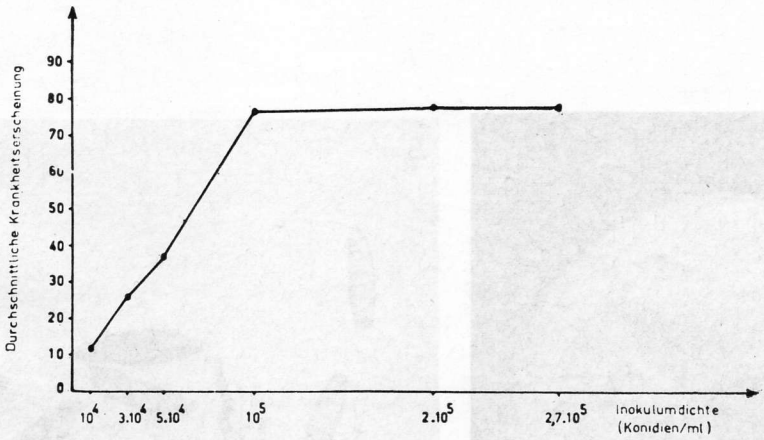

Abb. 7. Die prozentuale Befallsstärke bei Blattinokulationen mit **D. sorokiniana** mit unterschiedlicher Inokulumdichte.

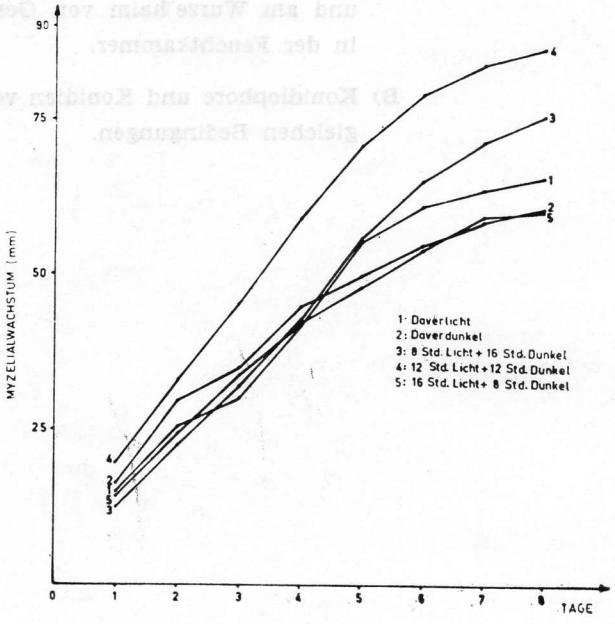

Abb. 6. Durchschnittliche Myzelwachstumsrate von **D. sorokiniana** auf PDA-Naehrboden bei 25°C and unterschiedlicher Belichtungsdauer.

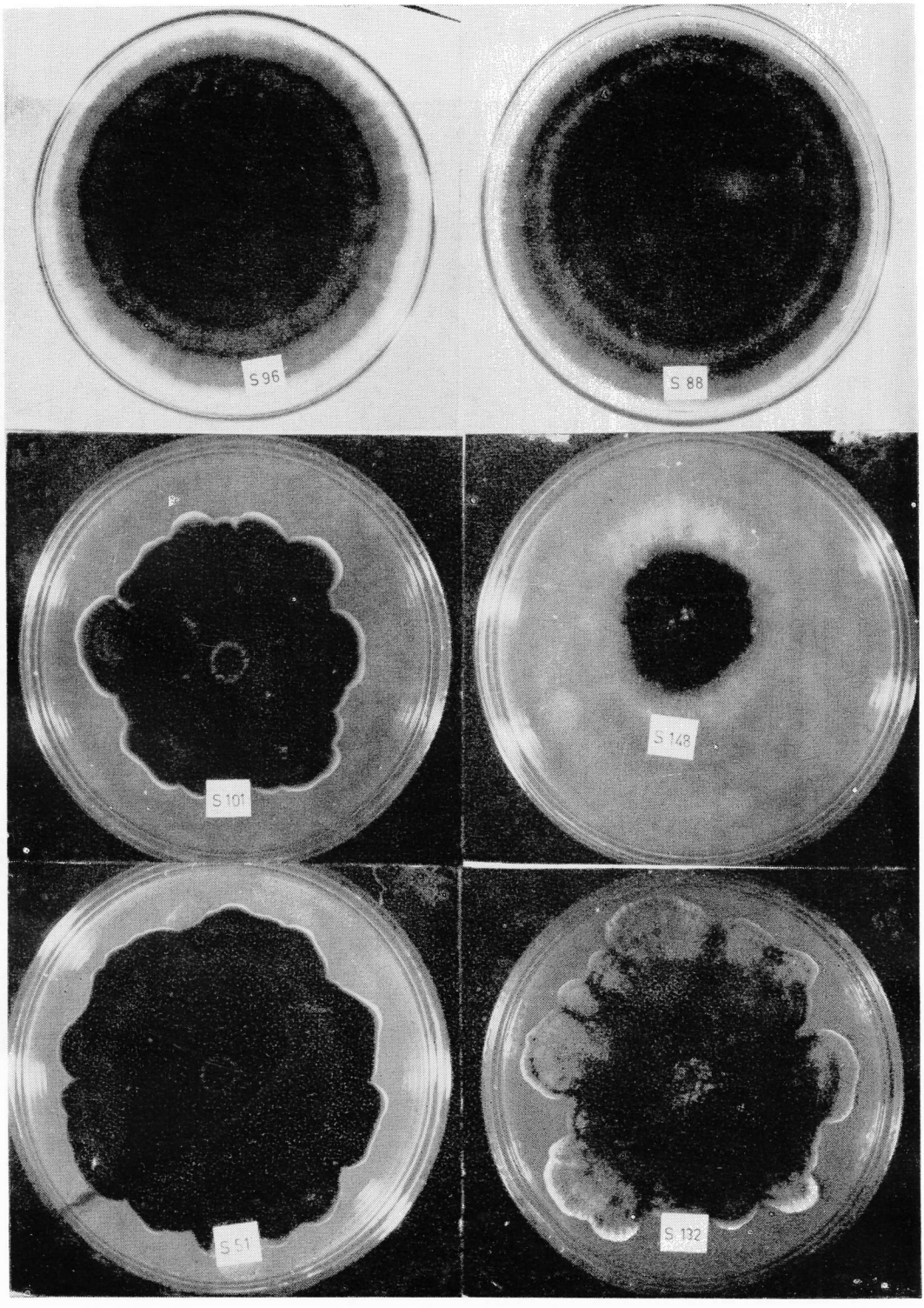

Abb. 8a. Siebentägiges Myzelwachstum der physiologischen Rasse von **D. sorckiniana** auf PDA-Naehrboden bei 25°C.

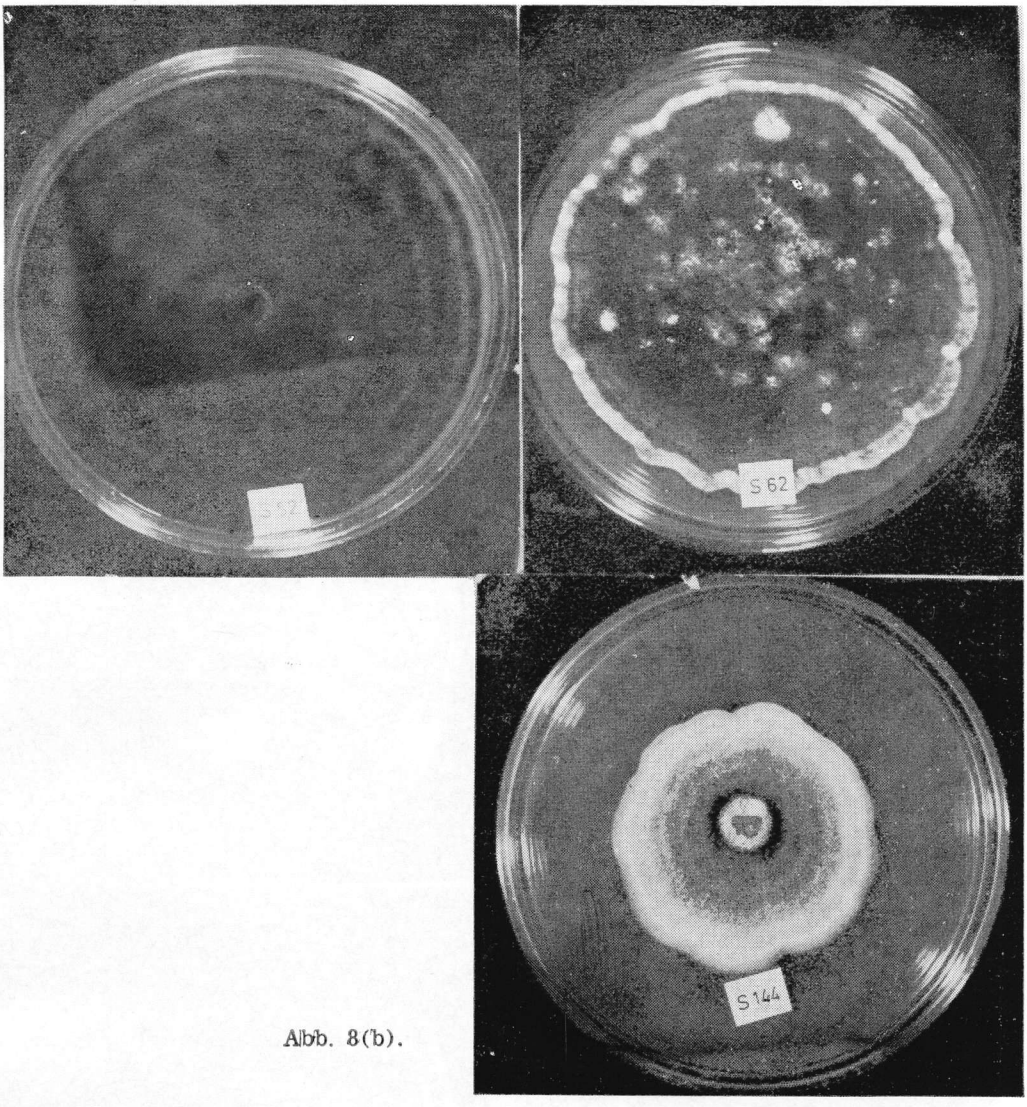

Abb. 8(b).

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Physiological Studies of **Alternaria helianthi** (Hansf.) Tubaki and Nishihara the Incitant of Leaf Blight of Sunflower (**Helianthus annuus** L.)

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ABSTRACT

The temperature 25 $\pm$ 1°C was most suitable for growth and sporulation of the fungus.

Among the six liquid media tried, the fungus grew best on Potato dextrose medium followed by Sabourd's and Richard's medium. Good sporulation was observed on Potato dextrose medium and no sporulation on other media.

pH 6.0 supported the maximum growth of the fungus but there was no sporulation at any of the pH levels tested.

Cellulose and starch proved to be the best carbon sources followed by sucrose and fructose. Good sporulation on cellulose and fair sporulation on starch was observed while no sporulation occurred on all other carbon sources.

Among all the nitrogen sources tested, maximum growth of the fungus was observed on peptone. No sporulation occurred on any of the nitrogen sources tested.

Among the different vitamins incorporated in the basal Richard's medium, biotin enhanced the growth of the fungus and there was no significant increase of dry mycelial weight on other vitamins over the control.

ALTERNARIA HELIANTHI

INTRODUCTION

During disease survey in September, 1974 the leaf blight of sunflower appeared in a severe form at the experimental farms of Rajasthan College of Agriculture, udaipur. **A. helianthi** was isolated from the affected parts and it proved pathogenic.

MATERIALS and METHODS

For studying the physiology of the fungus, glasswares were cleaned by dipping in potassium dichromate sulphuric acid solution for 24 hours and washed thoroughly first in tap water followed by distilled water. Corning glasswares and pure chemicals either laboratory reagents or Analar grade were used throughout the experiments.

All the physiological studies except temperature study, were done in liquid media. In case of liquid media, 20 ml of medium was distributed in each of 100 ml Erlenmeyer conical flasks. Glass distilled water was used for all the experiments. The solid media were sterilized at 15 lbs/sq. inch pressure for 15 minutes. The petridishes were sterilized at 180°C for one hour in hot air oven.

Mycelial growth was estimated by filtering through whatman filter No. 42, washed thrice in warm water and dried at 60°C in an oven till the mycelial mat showed a constant weight. The dried mycelium was weighed after cooling in a desiceator having calcium chloride crystals at the base. Analytical chemical balance was used for weighing. Richard's medium was used as the basal medium in all the physiological experiments. Single germinating spore was inoculated in each of 100 ml flask containing 20 ml of the medium and incubated at 25 $\pm$ 1°C in B.O.D. incubator.

To study the effect of temperature on growth and sporulation 20 ml of PDA was poured in each of the sterilized petridishes (10 cm). For the preparation of uniform inoculum, the fungus was inoculated in the centreof PDA plate and incubated at room temperature (28-30°C). After 16 days, 0.1 cm discs were cut from the periphery and the single disc was placed in the center of PDA medium contained in petriplates. The discs were placed in direct contact with the medium. The inoculated petridishes were incubated at 10, 15, 20, 25, 30, 35 and 40°C temperatures. Three replications were taken for each treatment and the growth was recorded after 18 days of incubation.

In order to find out a suitable medium for growth of the fungus, the liquid media used were Asthana & Hawker's medium; Brown's

medium; Czapek-Dox medium; Potato dextrose medium; Richard's medium and Sabourd's medium.

The pH of all the media were adjusted to 5.5 by adding N/10 HCI or N/10 NaOH before autoclaving. Hydrogen ion concentration of the medium after autoclaving was measured by pH meter. Four replications were taken for each medium and out of these one was used to determine the pH and sporulation. Dry weight of the mycelium and sporulation were recorded after 20 days of incubation at 25 $\pm$ 1°C.

To determine the optimum pH for growth, the pH of the basal medium was adjusted at different levels by adding N/10 NaOH or N/10 ACI. After autoclaving the pH was again tested. The flasks were inoculated with single germinating spore. It was a four replicated experiment and one was used to determine pH and sporulation after 20 days of incubation at 25 $\pm$ 1°C.

For the study of carbon and nitrogen nutrition, these compounds present in Richard's liquid medium were substituted with desired compounds in the quantity to give an equivalent amount of carbon and nitrogen present in the basal medium. It was calculated on the basis of their molecular weight. Four replications were maintained for each treatment and one was utilized to determine pH and sporulation. pH of the medium was adjusted to 6.0 before autoclaving in all the replications. The results were recorded after 20 days of incubation at 25 $\pm$ 1°C.

To know the effect of vitamins ot the growth and sporulation of the fungus, different vitamins were added in the basal medium at the rate of 50 ppm. The method described by Mathur **et al.** (1950) was used for making the medium vitamin free. The medium was boiled with 5 gm of Norit (activated charcoal) per litre for few minutes. The charcoal was removed by adjusted to 6.0 before autoclaving and flasks were autoclaved at 10 lbs/sq. inch pressure for 10 minutes. After inoculation of each flask with single germinating spore, they were incubated at 25 $\pm$ 1°C for 20 days and then the mycelial filtration. pH of the medium was weight and sporulation was recorded.

RESULTS and DISCUSSION

Temperature plays an important role on the growth and sporulation of the fungi. For each fungus there is a certain range of temperature for its growth and sporulation. The results of the experiments are presented in table—1.

Table—1. Effect of different temperatures on growth and sporulation of **Alternaria helianthi** incubated for 18 days.

S. No.	Temperature (°C)	Average colony diameter in mm	Sporulation
1.	10	9	—
2.	15	25	+ +
3.	20	52	+ + +
4.	25	63	+ + + +
5.	30	49	+ + +
6.	35	14	—
7.	40	0	—

C.D. at 5 % = 2.37
S.Em. = ± 0.77

— = No sporulation
\+ = Poor sporulation
+ + = Fair sporulation
+ + + = Good sporulation
+ + + + = Excellent sporulation

The results in Table—1 indicate that the fungus grew from 10°C and maximum growth and sporulation was at 25°C. The results are in confirmity with Worf and Wolf (1947) who observed that most of the parasitic fungi grow within a range of O°C to 42°C. Prabhu and Prasada (1966) also reported 25°C as the optimum temperature for the growth of **Alternaria triticina.**

Fungi exhibit a great diversity in their nutritional requirement. The results of the effect of synthetic and nonsynthetic liquid media on the growth and sporulation of **Alternaria helianthi** are presented in Table—2.

Table—2. Effect of different liquid media on growth and sporulation of **Alternaria helianthi** incubated at 25 + 1°C for 20 days

S. No.	Medium	pH after autoclaving	pH of filtrate	* Average dry myscelial weight (mg)	Sporulation
1.	Asthana & Hawker's	5.3	5.8	30	—
2.	Brown's	5.3	5.2	76	—
3.	Czapek-dox	5.6	5.9	50	—
4.	Patota dextrose	5.5	6.0	95	+++
5.	Richard's	5.4	5.9	82	—
6.	Sabourd's	5.5	5.1	85	—

* Average of 3 replications

C.D. at 5 % = 3.81

S.Em. = ± 1.21

Note — = No sporulation

+++ = Good sporulation

The results in Table 2 indicate that potato dextrose medium supported the maximum growth of the fungus followed by Sabourd's, Richard's, Brown's and Czapek-dox media. Least growth was observed on Asthana and Hawker's medium. Good sporulation of the fungus was noticed on potato dextrose medium while there was no sporulation on other media. In all the synthetic media mycelium of the fungus partially converted to beaded mycelium while it remained normal in potato dextrose and Sabourd's media. Among the synthetic liquid media Richard's medium supported the basal medium for further studies. The pH of all the media changed due to the growth of the fungus. The fungi as a result of their metabolic activity are reported to change the pH of the medium on which they grow (Lilly & Barnett, 1951), Ashour and Kadi (1959) evaluated 5 media and also found that PDA and Richard's media were the best and supported more rapid growth of **Alternaria tenuis** and **Rhizoctonia solani.** Among the five synthetic media tested, Richard's media supported maximum growth of **A. cyamposidis** (Singh & Prasada, 1973).

Though fungi grow over a wide range of pH, yet the optimum for mycelial growth and sporulation may differ from each other. The pH of a medium may be favourable for growth but unfavourable for sporulation. The results of the pH experiment are presented in table—3.

Table—3. Effect of different Hydrogen ion concentration on growth and sporulation of **Alternaria helianthi** incubated at 25 + 1°C for 20 days.

S. No.	pH before autoclaving	pH after autoclaving	pH of filtrate	* Dry mycelial weight (mg)	Sporulation
1.	4.0	4.1	5.2	28	No
2.	4.5	4.6	5.3	68	No
3.	5.0	5.0	6.1	75	No
4.	6.0	5.5	6.4	87	No
5.	6.5	6.0	6.5	103	No
6.	7.0	6.6	7.0	83	No
7.	7.5	7.2	6.8	70	No
8.	8.0	7.8	7.1	56	No
9.	9.0	8.2	7.3	47	No

* Average of 3 replications
C.D. at 5 % = 3.37
S. Em = ± 1.12

It is evident from the results in Table 3 that the fungus grew over o wide pH range (4.1 to 8.2). The maximum growth of the fungus was obtained at pH 6.0 and minimum at pH 4.0. There was no sporulation at any of the pH levels tested. Reddy (1967) also reported the maximum growth of **Alternaria triticina** at pH 5.5 and the least sporulation was observed at pH 6.0.

Carbon is essentially required by fungi as the main structural and functional element for the cell wall composition and other components of cell. The results of the effect of different carbon sources on growth and sporulation of the fungus are presented in Table—4.

Table—4. Effect of different «Carbon sources» on growth and sporulation of **Alternaria helianthi** incubated at 25 + 1°C for 20 days.

S. No.	Carbon source	pH after autoclaving	pH of filtrate	* Dry mycelial weight	Sporulation
1.	Xylose	5.9	6.0	64	No
2.	Glucose	5.7	6.4	75	No
3.	Fructose	5.6	5.9	81	No
4.	Galactose	5.5	6.3	66	No
5.	Sorbose	5.4	5.9	64	No
6.	Maltose	6.0	6.3	61	No
7.	Sucrose	5.7	6.2	87	No
8.	Raffinose	5.7	6.1	60	No
9.	Cellulose	5.8	6.6	95	Good
10.	Starch	5.8	6.2	93	Fair
11.	Control (No carbon)	5.9	6.2	15	No

* Average of 3 replications

C.D. at 5 % = 3.29

S.Em. = ± 1.11

The results in Table—4 indicate that among the 10 carbon sources tested, cellulose and starch were utilized to the maximum by the pathogen followed by sucrose and fructose. Raffinose and maltose were the poorest sources of carbon. Microscopic examination of the mycelial mats showed good sporulation on cellulose, fair sporulation on starch and no sporulation on other carbon sources tested. All fungi may not grow on the same source of carbon but most of them can use a large variety of them both for their growth and sporulation and this has been attributed to structural differences of these compounds (Lilly and Barnett, 1951). Monosaccharides are utilized by many fungi though they may not necessarily give best growth. Disaccharides, trisaccharides, polysaccharides and alcohols may be utilized by fungi depending upon the presence of hydrolytic enzymes and their ability to grow on their component sugars (Lilly and Barnett, 1951; Cochrane, 1958). Chattopadhyay et al. (1970) repor-

ted that H_1, H_9, H_{12}, H_{16} and H_{38} strains of **Helminthosporium oryzae** incitant of brown spot disease of rice, utilized cellulose as the best source of carbon. Singh and Prasada (1973) reported that **Alternaria cyamopsidis** utilized starch, xylose, glucose, maltose etc. as carbon sources and the best source of carbon was D-fructose. Joly (1962) investigated the carbon requirements of **A. citri, A. tenuissima, A. oleraceae** and **A. dianthi** and the best source of carbon for all these species was fructose followed by fructosans.

In order to study the ability of the fungus to utilize various nitrogen sources this experiment was performed. The results are indicated in table—5.

Table—5. Effect of different «Nitrogen sources» on growth and sporulation of **Alternaria helianthi** incubated at 25 + 1°C for 20 days

S. No.	Nitrogen source	pH after autoclaving	pH of filtrate	* Dry mycelial weight (mg)	Sporulation
1.	Ammonium chloride	5.9	6.1	48	No
2.	Ammonium nitrate	5.8	6.2	55	No
3.	Potassium nitrate	5.9	6.0	98	No
4.	Sodium nitrate	6.3	6.0	76	No
5.	Urea	5.8	6.8	75	No
6.	DL-methionine	5.9	6.4	88	No
7.	Histidine	6.0	5.9	75	No
8.	DLB phenyl alanine	5.8	6.1	102	No
9.	L-asparagine	5.6	5.9	85	No
10.	DL-aspartic acid	5.8	5.7	70	No
11.	Glutamic acid	5.7	5.8	78	No
12.	DL-tryptophan	5.7	5.8	62	No
13.	Peptone	5.9	5.7	110	No
14.	Control (No nitrogen)	5.6	6.0	20	No

* Average of 3 replications
C.D. at 5 % = 4.83
S.Em. = ± 3.57

The results in Table 5 indicate that among the inorganic nitrogen sources, potassium nitrate supported good growth of the fungus while least growth was observed on ammonium chloride. Among the organic nitrogen sources peptone supported the best growth of the fungus followed by DL^{B} phenylalanine, DL-methione, L-asparagine, glutamic acid, histidine and urea while poorest growth of the fungus was recorded on DL-tryptophan. Scanty growth was observed on control.

Peptone supported maximum growth of the fungus among all the nitrogen sources tested Rajaerkar (1966) also reported the maximum growth of **Alternaria solani** on peptones.

The results of the effect of vitamins on the growth and sporulation of the fungus are presented in Table—6.

Table—6. Effect of different vitamins on growth and sporulation of **Alternaria helianthi** incubated at 25 $\pm$ 1°C for 20 days

S. No.	Vitamins	pH After autoclaving	* Dry Mycelial weight (mg)	Sporulation
1.	Ascorbic acid	5.8	92	No
2.	Biotin	5.7	105	No
3.	Folic acid	5.9	93	No
4.	Inositol	6.1	98	No
5.	Nicotinic acid	5.8	93	No
6.	Phyridoxine hydrochloride	5.8	100	No
7.	Riboflavin	6.2	101	No
8.	Thiamine hydrochloride	5.7	96	No
9.	Control (No vitamin)	5.8	95	No

* Average of 3 replications

C.D. at 5 % = 6.77

S.Em. = $\pm$ 2.55

The data in Table—6 indicated that biotin enhanced the growth of the fungus and there was significant increase of dry mycelium weight over the control. Ascorbic acid, folic acid, inositol, nicotinic acid, phyridoxine hydrochloride, raffinose and thiamine hydrochloride were at par with the control. None of the vitamins induced sporulation of the fungus. Similarly Gemawat and Prasad (1971) found no significant increase in the growth of **Alternaria burnsii** when different vitamins were tested but the sporulation increased with a combination of biotin and pyridoxine.

ÖZET

AYÇİÇEĞİ YAPRAK LEKE LASTALIĞI ETMENİ (**Alternaria helianthi** (Hansf.) Tubaki and Nishihara ÜZERİNDE FİZYOLOJİK ÇALIŞMALAR

Fungusun gelişimi ve sporulasyonu için 25 ± 1°C en uygun sıcaklık olmuştur. Teste alınan altı besi yerinden en iyi gelişimi sağlayan Patates - Dekstroz Agar (PDA) ortamı olmuş ve bunu Sabourd ve Richard ortamı takip etmiştir. PDA ortamında iyi sporulasyon gözlenmiş ve diğer ortamlarda sporulasyon olmamıştır.

Fungus 6PH derecesinde en fazla gelişim göstermiş ve denenen tüm PH derecelerinde sporulasyon saptanmamıştır.

Selüloz ve Nişasta gelişim için en iyi karbon kaynağını oluşturmuş ve bunları sukroz ve fruktoz takip etmiştir. Selülozla iyi, nişasta ile zayıf sporulasyon görülürken diğer karbon kaynaklarında hiç sporulasyon olmamıştır.

Teste alınan azot kaynaklarından, en fazla gelişmeyi sağlayan pepton olmuştur. Hiç bir azot kaynağı sporulasyonu sağlamamıştır.

Temel ortam olarak Richard besi yeri alınmış ve buna katılan farklı vitaminlerden Biotin, fungusun gelişmesini arttırmış; ancak kuru misel ağırlığında vitaminlerin hiçbiri kontrolun üzerinde önemli bir artış sağlamamıştır.

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Decline of Satsuma Mandarin Orange in Turkey

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ABSTRACT

This is the preliminary report on the decline of Satsuma mandarin trees in Turkey. Infected Satsuma mandarins on sour orange **(Citrus aurantium)** have recently shown serious decline involving die-back, defoliation and eventual death of trees. The external symptoms were stunting, die-back, over-growth above the bud-union of the sour orange rootstock, xyloporosis like bark scallings and cankers commonly occured through the Satsuma scion trunk above the bud union. The internal symptoms were bristly pegs on the woody cylinder of both scion and sour orange rootstock and circular pits in the inner face of the bark.

The indexing tests with Mexican lime and the macroscopic examinations showed that, declining on satsuma trees were the combination of tristeza and xyloporosis virus infections.

INTRODUCTION

Severe declining have been noticed on Satsuma mandarin trees since 1974 in the experiment region. Tristeza and xyoloporosis were found more distributed in our Satsuma plantings as previously reported (Azeri and Karaca, 1978; Azeri and Heper, 1978). Declined Satsuma trees have been examined for Tristeza, xyloporosis, psorosis, exocortis and Satsuma Dwarf viruses and indexed with Mexican lime.

MATERIALS AND METHODS

Since 1974 declined Satsuma mandarin trees in the experiment region (İzmir, Merkez and Gümüşsu Region) have been examined for tristeza, xyloporosis, exocortis, psorosis and Satsuma Dwarf virus diseases as described by Azeri and Heper (1978), and also indexed with Mexcan lime for tristeza virus.

Naturally infected declined 25 Satsuma mandarin trees on sour orange rootstock in 5 orchards, and 6 Satsuma trees on **P. trifoliala** rootstock in 3 orchards with the

typical declining symptoms have been indexed with Mexican lime for tristeza virus.

Leaf insert and chip bud inoculations have been applied in the indexing tests, and 3 Mexican lime were used in each test (Azeri and Karaca, 1978)

RESULTS AND DISCUSSION

Symptoms :

The obvious external symptoms on the declined Satsuma trees were; stunting, severe defoliations, sparseness of foliage, chlorosis, zing deficiency, die-back, gradual decline and death of the trees in the latter stages (Fig 1). The affected Satsuma trees both on sour orange and **Poncirus trifoliata** rootstocks showed xyloporosis like scallings or cankers on the Satsuma scion trunk above the bud union (Fig 2). When a piece of bark have been pulled out from the union of a declined Satsuma trees on sour orange rootstock, the typical tristeza honeycombing like pits usually were present just below the bud union (Fig 3, at the right bark speciment). Circular pits in the different size were also present above the bud-union in the inner face of the satsuma barg (Fig 4) throghout the branches and bristly pegs on the woody sylinder of the Satsuma scion (Fig 5). Pegs and pits as much as 0,5 mm in diam have also been observed in the branches of the declined trees.

Most of the infected trees showed scalling and cracking of bark above the bud-union. Elongated mound like pegs usually associated with typical xyloporosis have elways been seen on the inner face of the bark above the bud-union (in fig 3, at the left barkspeciment). Infected Satsuma tree trunks on sour orange stocks developed larger cankers than those on **P. trifoliata.** Bark sections taken from the bud-unions showed that, the Satsuma portions of the bark of infected trees were thicker than those from unaffected trees as shown in Fig 3 and Fig 4. Xyloporosis brownish gum deposits occurred in the phloem of such Satsuma scion bark (Fig 4) regardless of rootstock but not in the sour orange rootstock bark. Naturally infected some diseased Satsuma mandarins on **P. trifoliata** rootstock also displayed the same invers pittings and the cankers at the Satsuma scion bark.

The indexing results revealed that, all of the indexed 31 declined trees gave positive tristeza reaction on Mexican lime indicators.

The Declined trees which show above symtoms were naturally infected with tristeza virus. All declined trees have elso been showed the typical xyloporosis like small and large pits and gumming in the bark and pegs on the woody cylinder of the Satsuma scion as described by Calavan and Christiansen (1965), Tanaka and Yamada (1961).

Satsuma trees inoculated with tristeza virus alone, could not develope pits and the bristly pegs on the Satsuma scion as reported by Yamada and Tanaka (1969). When the Satsuma were inoculated with xyloporosis virus alone, developed typical gum-impragnated pegs in the Satsuma scion bark just above the bud-union as previously reported (Azeri and Heper 1978, fig 6). The recent field survey showed that, xyloporosis virus was widespreaded in the experiment region (Azeri and Heper 1978). Tristeza also was found more distributed (from 20 % to 100 % in some satsuma orchards) in the Satsuma mandarin trees. Some Bodrum Common mandarins, limons and Sweet orange trees near the tristeza infected Satsuma trees in the same orchards were found naturally infected with tristeza virus. The last three species were known free from tristeza in Turkey. Melon aphid **Aphis gossypii** Glov and **A. Spiraecola** are presant in aur Citrus orchards (Azeri and Karaca 1978, Lodos 1981). Natural spread of tristeza probably may be due to these two aphids, which are known the thristeza vectors (Joseph et al 1973, Lodos 1981).

The indexing tests and the field examinations revealed that, the characteristic declining symptoms observed on Satsuma mandarins were the combinations of both tristeza and xyloporosis virus infections. Eradication of these unfruituful and declined Satsuma trees and replanting with the virus free helthy plants is necessary in the short time. It is also necessary to initiate short-term and long-term indexing and the budwood registration programe to establish virus free Satsuma mandarins lines and fondation blocks in Turkey.

T. AZERİ

ÖZET

SATSUMA MANDARİNLERİNDE GÖÇME

Son yıllarda İzmir ilinde üretilmekte olan bilhassa turunç anacı üzerine aşılı Satsuma mandarinlerinde şiddetli bodurlukla birlikte ölüm belirtileri saptanmıştır. Bu şekilde göçme gösteren Satsuma mandarinlerinin aşı noktasından alınan kabuk kesitlerinde, turunca ait kabuğun alt yüzeyinde Göçüren (tristeza) virusunun tipik çukurluk (honeycombing; pits) belirtileri ile, odun yüzeyinde balık dişi şeklinde çıkıntılar (invers-pitting-pegs) görülmüştür. Aşı yerinin üst kısmındaki satsuma gövdesinde ise, Gözenek (xyloporosis) virusuna benzer geniş kanser yaraları ile kabuk soyulmaları saptanmıştır. Aşı yerinin üzerinden alınan kabuk kesitlerinde, Satsuma gövdesine ait kabuk kesitlerinin alt yüzeyinde tristezadan farklı olarak şiddetli çukurluklar ile bunun karşıtı olarak odun yüzeyinde çıkıntılara rastlanmıştır. Satsuma kabuğunun virusssus olana oranla 2-3 misli kalın ve floeminde Gözenek (Xyloporosis) virusunun tipik zamk paketleri olduğu görülmüştür. Satsuma gövdesindeki bu belirtilerin bodur ağacın dallarına kadar yayıldığı izlenmiştir. Üç yapraklı anaç üzerine aşılı bazı satsuma mandarinlerinin aşı yerinin üst kısmındaki satsuma gövdesinde ayni belirtilere rastlanmıştır. Uygulanan endeksleme testleri ve simptomatolojik gözlemler sonucu, Satsuma mandarinlerimizde görülen ölüm belirtilerini Göçüren (tristeza) ve Gözenek (Xyloporosis) viruslarının müşterek infeksiyonlar sonucu oluşturduğu saptanmıştır.

Yapılan araştırmalar, bu iki virusun satsuma mandarinlerimizde yaygın olarak bulunduğunu, tek başına veya müştereken bulunduklarında farklı şekilde zarar yaptıklarını göstermiştir. Göçüren virusunun vektörü olan **Aphis gossypii** Glov. ve **A. Spiraecola** Turunçgillerimizde mevcuttur. Son yıllarda turunç üzerine aşılı Bodrum mandarinleri, limon ve portakallarda tristeza virusuna rastlanmıştır. Halbuki bu varyetelerin ülkemizde Tristeza'dan ari oldukları bilinmektedir. İhtimalen, doğal olarak bulaşma bu iki afit vektöründen ileri gelmektedir. Zira, bazı Satsuma mandarin plantasyonlarında hastalığa % 50-100 oranında rastlanmaktadır.

Satsuma mandarinlerimizde Göçme durumları yıldan yıla tehlikeli boyutlara ulaşmakta olmasına rağmen bu güne kadar etken bir önlem alınamamıştır. Bu nedenle, bir an önce endeksleme proğramları ile virussus Satsuma üretim ve geliştirme projelerinin başlatılması gerekmektedir.

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Fig. 1. Severely affected declined Satsuma on sour orange rootstock naturally infected with tristeza and xyloporosis viruses.

Fig. 2. Xyloporosis like bark craking and canker on the Satsuma Scion above the bud union. And tristeza like overgrow at the bud union.

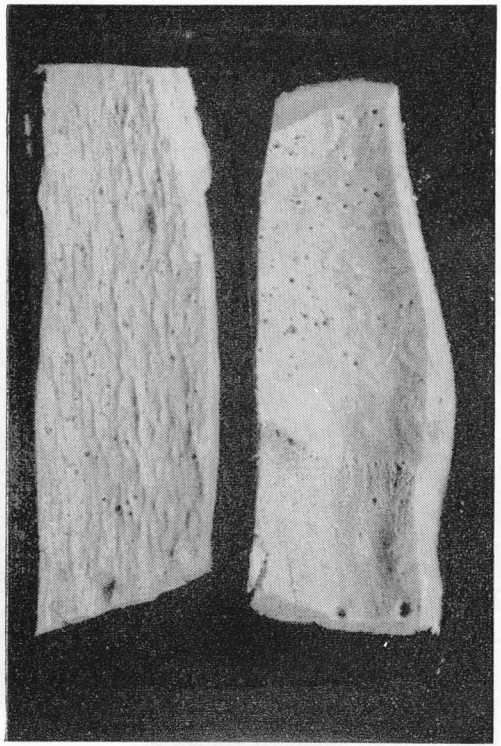

Fig. 3. Honeycombing pits of tristeza just below the bud union (at the right bark spesiment) and xyloporosis like pits and pegs above the bud-union of a Satsuma on sour orange (at the left side).

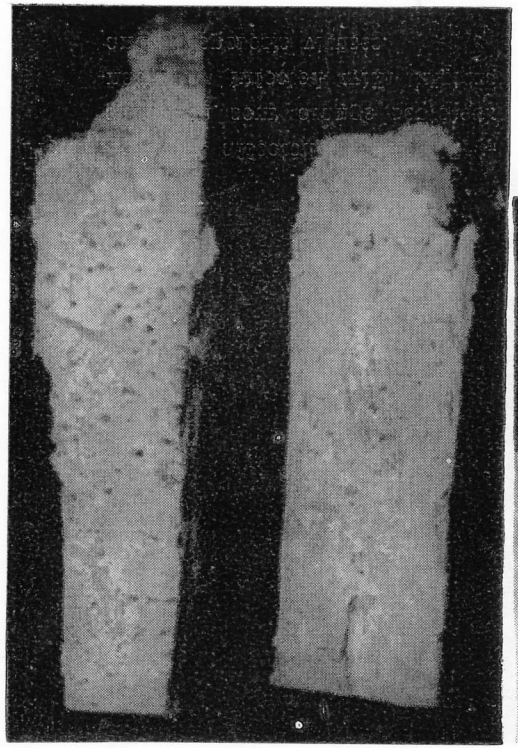

Fig. 4. Bark specimens of the Satsuma scion showing typical xyloporosis like large and small pits and gum depositions in the scion bark.

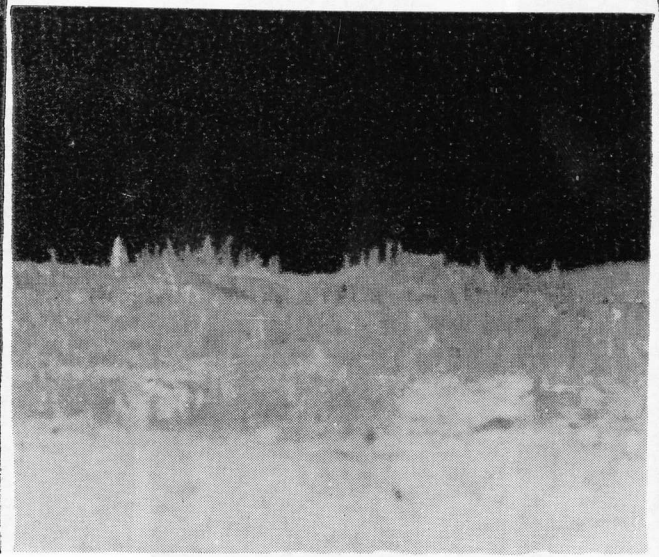

Fig. 5. Bristly like pegs on the woody sylinder of the Satsuma scion affected with tristeza and xyloporosis.

Fig. 6. Redial section of Satsuma scion bark showing typical gum impregnated pegs of xyloporosis virus.

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Heterodera fici Kirjanova 1954 in Aegean Region

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ABSTRACT

Heterodera fici Kirjanova was firstly recorded on **Ficus carica** and **Ficus domestica** in June 1979 in Aegean Region. Turkey. Descriptive studies on cysts, males, larvae and comparative studies with **Heterodera cruciferae** were done. In deeper focus apart from the other **Heterodera** species big patches are seen. The length from anus to the begining of hyaline part over tail length ratio percentage is also a descriptive character. In selected fresh cysts at the initiation of hatching period 171-472 eggs were counted.

INTRODUCTION

Very little is known about this nematode. It was firstly recorded and described by Kirjanova on ornamental ficus in Russia. Later on Sher and Raski (1956) reported it on **Ficus elastica** showing poor growth in nursery at California. In Turkey this nematode was firstly recorded in June 1979 on figs in Aydın Province. On roots cysts and in soil besides cysts, larvae and males were obtained. Unlike to other known cyst nematodes, fig cyst nematode can not be seen easly on roots and the cysts usually do not left in soil when the roots are pulled up. So that cysts are mainly obtained from roots. Since most of the cysts are placed in the cracks of the roots and the subcrystalline layer of the cyst wall sticks so closely to the roots, they are not easly left in soil. This biological aspect should be considered during root washing.

In Erzurum under the conditions similar to green house, inoculation studies on Ficus genus gave succesfull results and in two years the population of this nematode were highly increased.

During the survey studies in Aydın Region the damage of this nematode on **Ficus carica** and on **Ficus domestica** was not taken into account. Unless detailed studies about the destruction level of this nematode in various fig growing areas including ecological conditions will give us information about the relation of **H. fici** with fig.

MATERIALS and METHODS

Soil and root samples were taken about from the top 40 cm layer around the root region of fig trees. The root and soil samples were mixed together with water and then passed through a series of screens. The roots left in 30 mesh screen were taken and placed to an another container and they are rubed against each other with hand. Then it was passed through 30 and 60 mesh screens and the cysts detached from the roots were collected on both screens. Small root and bark pieces containing the cysts which are broken from the roots as a resut of rubbing are collected on 30 mesh screen.

In calculating the real number of eggs, the cysts bearing distinct subcrystalline layer or the ones which are not easly depressed when pressed with an arrow pointed needle were selected. These were seperately crushed in 10 % KOH solution and the eggs were counted under streo-microscope.

The identification of **H. fici** were done according to the original description and drawings of Kirjanova.

RESULTS and DISCUSSION

Heterodera fici Kirjanova

Description: Female (N=15) : L=1.04 (0.8—1.4) mm; Width 0.7 (0.5—1.08) mm; Width and length ratio % 68; Lenght 1.4 (1—1.5) times of width; number of eggs (N=10) = 284 (171—472). Body form lemon shaped, but both ends nearly rounded (Fig. 1).

Near mid body rugose markings are zig zag lines, but usually not closely spaced and forming a lacy pattern (Fig. 2). With deeper focus big irregular patches are appear (Fig. 3). Cuticula punctations minute, irregular, the lips of the vulva are open (Fig. 3).

Male (N=11) : L=0.953 (0.843—1.07) mm; Stylet lobes rounded (Fig. 5A).

2. stage larvae (N=15) : L=375 (327—468) mu; Stylet knobs convex anteriorly and the angle between the meso-metarhabdion narrow (Fig. 5B) The length from anus to the begining of hyaline part over tail length ratio (N=15) : % 43.5 (40—46.2).

From the point of general appereance of cysts, between the **Heterodera** species of our country **Heterodera cruciferae** is mostly resembles to **H. fici.** The percentage ratio of widthe over lengths is same

in both. In deeper focus on **H. cruciferae** punctations, on **H. fici** biğ patches are seen. Additionaly, the lips of the vulva are open in **H. fici.**

On the other hand contrary to other cyst nematodes in fig cyst nematode the difficulty in detecting them on roots and a biological aspect such as the firm attachment of cysts to roots are the practical way of identifiying this species.

According to Kirjanova (1954) a female contains 100-230 eggs, but in our calculations 171-472 eggs were determined. It is supposed that this difference might be resulted from calculating aggs in old cysts as well. Because in some instances old cysts may contain 20-30 eggs or may be completely empty.

It is possible to differ the males of these species by the shape of stylet knobs. In fig cyst nematode the stylet knobs are spherical, in the other they are in pear shape.

The length of the larvae of the fig cyst nematode of our country is identical to the values obtained by Kirjanova (1954) and Thorne (1962). The larval length is not an important taxonomic character since the values of fig and cabbage cyst nematodes are overlap to each other. The teeth of the stylet knobs are also similar in shape. The length from anus to the begining of hyaline part over tail length ratio percentage is a descriptive character. The mean ratio in cabbage cyst nematode is % 51 (Yüksel, 1973) and in fig cyst nematode it is % 43.5.

ÖZET

EGE BÖLGESİ'NDE Heterodera fici Kirjanova

1979 yılında Aydın ve dolaylarında İncir Kök bölgelerinden alınan örneklerde köklerde **Heterodera fici** sistlerine, toprakta ise bunların sist, erkek ve larvalarına tesadüf edilmiştir. **H. fici**'nin teşhisi Kijanova'nın orijinal tavsif ve çizimlerine göre yapılmıştır.

Diğer **Heterodera** sistlerine nazaran bu nematod'un köklerde zor görülmesi ve buradan toprağa intikali kolay olmadığı için, kökler su içerisinde oğuşturulduktan sonra muhteviyat 30-60 mesh'lik eleklerden geçirilerek bol miktarda sist elde edilebilmektedir.

İncir sist nematodu populasyonları sulanan alanlarda sulanmayanlara nazaran daha yüksek bulunmuştur.

Sistlerin tanınmasında daha derin fokustaki sist duvarının görünümü; larvanın tanımında ise Anus-Hiyalin başlangıcının, kuyruk uzunluğuna oranının yüzdesi ise önemli karekter olarak görülmektedir.

Sistlerdeki yumurta sayısı literatürde verilene nazaran çok yüksek olarak bulunmuştur (171-472).

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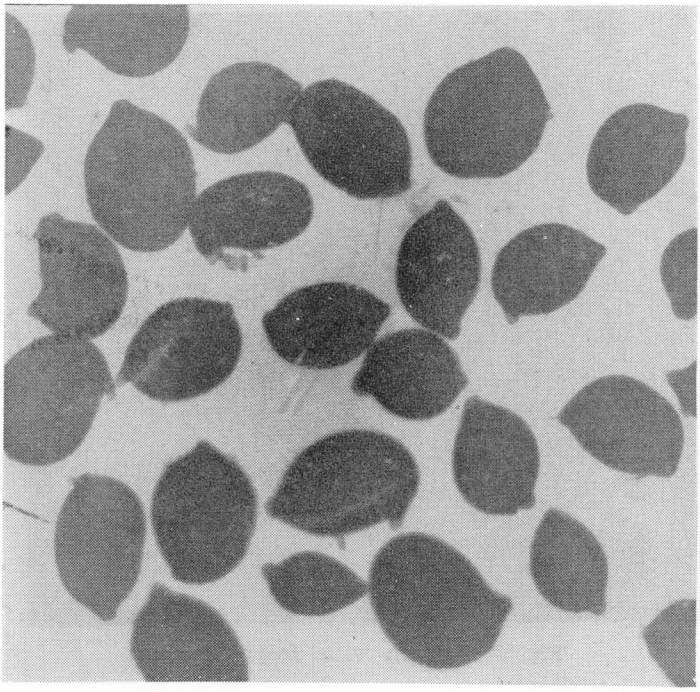

Fig. 1. General appereance of cysts.

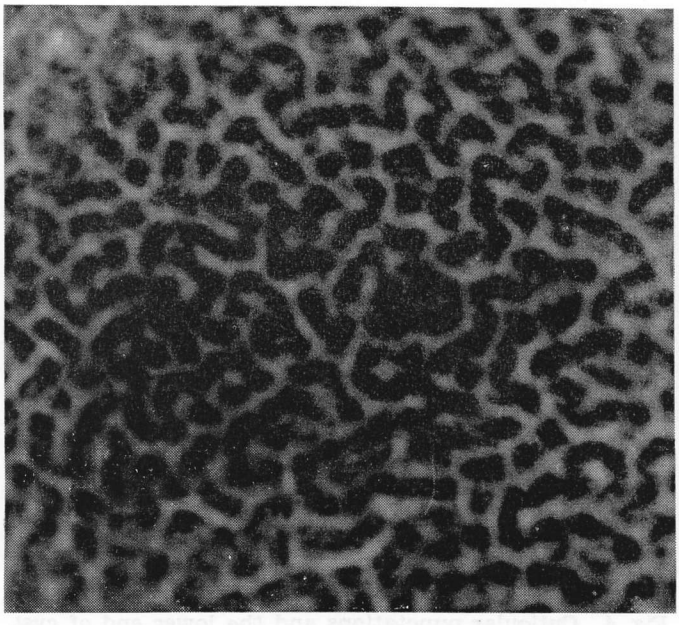

Fig. 2. Pattern near middle of cyst.

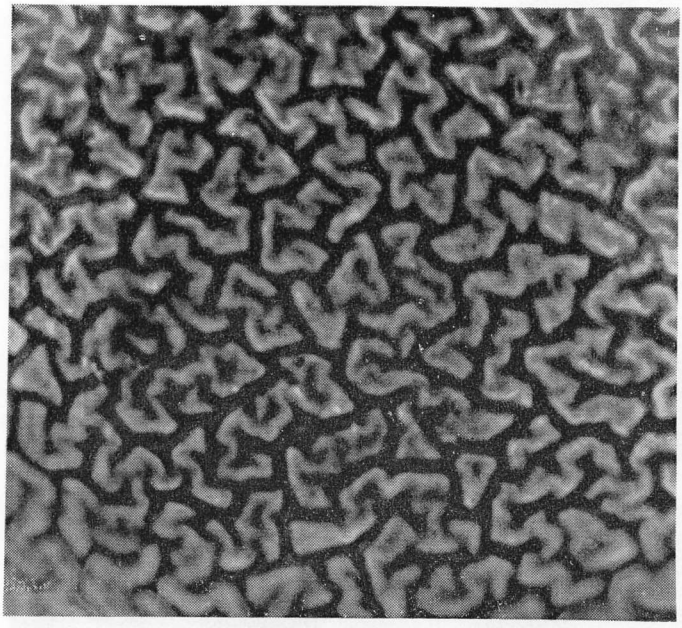

Fig. 3. Pattern with deeper focus

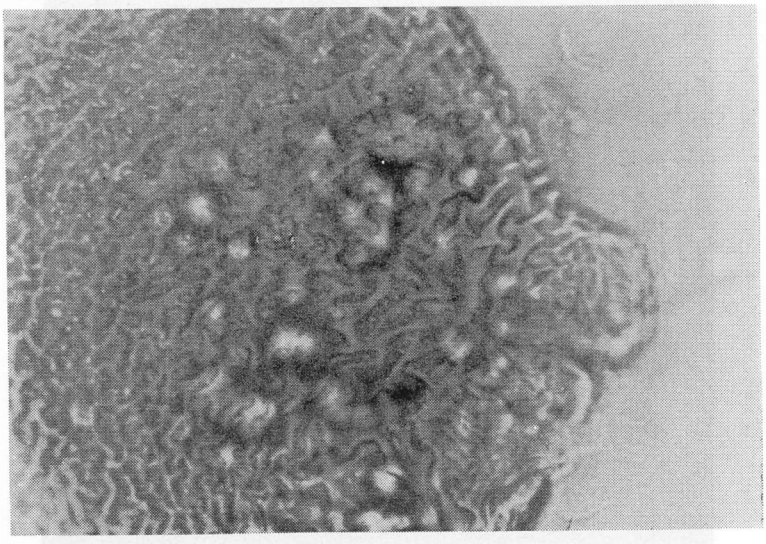

Fig. 4. Cuticular punctations and the lower end of cyst.

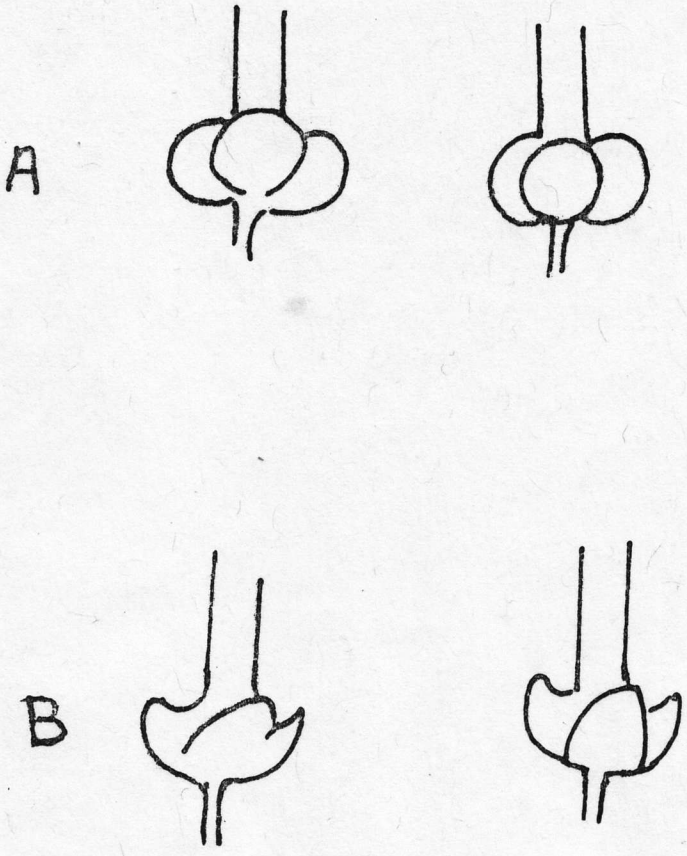

Fig. 5. Stylet knobs; A: Males, B: Second stage larvae.

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Determinations of Fungal Diseases on the Commercially Grown Ornamental Plants in Aegean Region

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Recently, commercially grown ornamental plants have been gained relatively high importance. Especially, in certain areas it is quite widely spread and profitable section of agriculture. Ornamental plants are widely grown in Ege Region too. In order to establish the diseases caused by fungal agents on ornamentals a series of surveys were conducted in greenhouses and gardens where the ornamental plants were grown commercially. In the years of 1979 and 1980 the survey area was covered the vicinity of İzmir, namely Balçova, İnciraltı, Narlıdere, Seferihisar, Mordoğan, Karaburun, Foça, Bornova and Cumaovası.

During the surveys diseased plants were collected from green houses and gardens. Collected diseased samples were examined under the microscope and if necessary the cultures were made. The isolation media were 2 % PDA and 8 % wateragar. The petri dishes were incubated at room temparature. Pathogenicity tests were performed in pots.

At the end of the surveys disease-causing fungi on ornamental plants were established and given in the following.

Table: Disease-causing fungi and their symptoms on host plants

Host plants	Pathogens	Symptoms	Literatüre
Anthurium spp.	X Gloeosporium sp.	Leaf spot	Pape (1964)
	X Colletotrichum sp.	Leaf spot	Pape (1964)
	X Pestaiotia sp.	Leaf spot	
Asparagus Sperngeri Regel.	X Botrytis sp.	Shoot blight and greymold	
	X Colletotrichum sp.	Leaf spot	
Asparagus plumosis Bak.	X Botrytis sp.	Shoot blight and greymold	
Azalea sp.	XX Exobasidium sp.	Gal disease	Rautenberg (1973)
Begoniae spp.	Oidium begoniae Putt.	Powdery mildew	Bremer et al 1948), Oran (1967)
	X Gloeosporium sp.	Leaf spot.	Pape (1964)
	X Colletotrichum sp.	Leaf spot.	Carvalho and Mendes (1958)
	Phyllosticta sp.	Leaf spot	Bremer et al (1948)
	X Alternaria sp.	Leaf spot.	Pape (1964)
	Botrytis sp.	Leaf blight	Bremer et al (1948)
Calendula officinalis L.	Sphaerothace fuliginea (Schlecht.) Salm.	Powdery mildew	Bremer et al (1952)
	X Alternaria sp.	Leaf spot	Pape (1964)
	X Botrytis sp.	Leaf blight.	Dodge and Rickett (1948)
	X Sclerotinia sclerotiorum (Lib.) Mass	Stem rot.	
Callistephus sp.	X Fusarium sp.	Wilt	Pape (1964)
Chrysanthemum spp.	X Botrytis sp.	Leaf blight.	Magie (1963)
	X Pleospora sp.	Leaf and stem spot.	Pape (1964)
	Septoria sp.	Leaf spot	Karel (1958), Gürcan (1976)
	X Ascochyta sp.	Leaf spot	Sauthoff (1962)
	S. sclorotiorum (Lib.) Mass.	White rot.	Bremer et al (1948)
	X Pestalotia sp.	Leaf spot.	

Host plants	Pathogens	Symptoms	Literatüre
Dahliae spp.	Erysiphe polygoni D.C.	Powdery mildew	Smith (1940)
Dianthus	Uromyces caryophyllinus (Schr.)	Rust.	Karahan (1969)
caryophyllus L.	Alternaria dianthi Stev. et Hall.	Leaf and stem spot	Bremet et al (1952)
	X Botrytis sp.	Flower rot.	Savules cu et al (1967)
	X Pleospora sp.	Leaf and stem spot.	Silvertham et al (1977)
	X S. sclerotiorum (Lib.) Mass.	Stem and root rot.	
	X Fusarium spp.	Wilt.	
Ficus spp.	X Botrytis sp.	Grey mold	
Fushsia sp.	X Gloeosporium sp.	Leaf spot	
	X Phytophthora sp.	Root rot.	Pape (1964)
	X Rhizoctonia sp.	Root rot.	
Gerbera	X Botrytis sp.	Petal spot	Orlikowski (1980)
jasmesonii	X Alternaria sp.	Leaf spot	Curtis (1962)
	X Erysiphe polygoni D.C.	Powdery mildew	Smith (1940)
	X Pestalotia sp.	Leaf spot	
	X S. sclerotiorum (Lib.) Mass.	Stem rot (White rot)	Vigodosky (1969)
	X Macrophomina sp.	Root rot	
Gelsemium sp.	X Ascochyta sp.	Leaf spot	
Gladiolus	X Botrytis sp.	Leaf and flower spot.	Anonymus (1971)
	X Pleospora sp.	Leaf spot.	Bald (1953)
	X Culvularia sp.	Leaf spot	Beute (1973)
	Rhizoctonia sp.	Nect rot	Bremer et al (1948)
	X Fusarium spp.	Corm rot	Pape (1964)
	X Alternaria sp.	Leaf spot.	Simmons (1951)
	X Macrophomina sp.	Neck rot	
Hedera helix L.	Ascochyta sp.	Leaf spot	Karel (1958)
Hoffmania helix L	X Ascochyta sp.	Leaf spot	

Host plants	Pathogens	Symptoms	Literatüre
	× Botrytis sp.	Blight	
Hoya sp.	X Gloeosporium sp.	Leaf spot	
Hyacinthus sp.	Puccinia liliacearum Dub.	Rust	Bremer et al (1948)
	Botrytis sp.	Grey mold and blight.	Bremer et al (1948)
	X Septoria sp.	Leaf spot	
	Pleospora sp.	Leaf spot	Bremer et al (1948)
Hydrangea sp.	X Gloeosporium sp.	Leaf spot	
Impatiens balsamina	X Rhizoctonia sp.	Root rot.	Dodge and Rickett (1948)
Iris sp.	X Pleospora sp.	Leaf spot	
	X Botrytis sp.	Leaf spot	
	Stagonospora sp.	Leaf spot	Bremer et al (1948)
	X Sclerotium sp.	Soft rot	Pape (1964)
	X Fusarium sp.	Basal rot	Pape (1964)
Jasmimum spp	X Gloeosporium sp.	Leaf spot	Pape (1964)
Kalanchoe sp.	X Botrytis sp.	Leaf blight	
Ligustrum sp.	X Ascochyta sp.	Leaf spot	
	X Gloeosporium sp.	Leaf spot	
Lilium spp.	X Botrytis sp.	Leaf blight.	Smith (1940)
Lonicera capri folium L.	Microsphera viburnii	Powdery mildew	Karaca (1961)
Magnolia sp.	X Ascochyta sp.	Leaf spot	
Mathiola sp.	X Sclerotinia sp.	Root rot	Forsberg (1963)
Momordica cherantia	X Botrytis sp.	Leaf blight	
Narcissus sp.	X Pleospora sp.	Leaf spot	
	Stagonospora sp.	Leaf spot	Bremer et al (1948)
Nerium oleander	X Ascochyta sp.	Leaf spot	Dodge and Rickett (1948)
	X Phoma sp.	Pruning-Wound dieback	Keim (1979)
Nymphaea sp.	X Gloeosporium sp.	Leaf spot	

Host plants	Pathogens	Symptoms	Literatüre
Orchidaceae	X Colletotrichum sp.	Leaf spot	Pape (1964)
	X Ascochyta sp.	Leaf spot	
	X Gloeosporium sp.	Leaf spot	Pape (1964)
	X Septoria sp.	Leaf spot	
	X Pestalotia sp.	Leaf spot	
Oxalis hedysaroides	X Gloeosporium sp.	Leaf spot	
	X Pestalotia sp.	Leaf spot	
Paeonia sp.	X Ascochyta sp.	Leaf spot	
Palisota manni	X Gloeosporium sp.	Leaf spot	
Palmae	X Ascochyta sp.	Leaf spot	
	XX Pestalotia palmarum Cke.	Leaf blight	Pape (1964)
	XX Pseudoepicoccum sp.	Leaf spot.	Ellis (1964)
	X Diplodia sp.	Leaf spot.	Pape (1964)
	X Gloeosporium sp.	Leaf spot.	
Pelargonium spp.	Rhizoctonia sp.	Root rot	Bremer et al (1948)
	X Gloeosporium sp.	Leaf spot	
	Puccinia pelargonii - zonalis	Rust	Gürcan (1976)
	X Alternaria sp.	Leaf spot	Corazza (1976)
	Botrytis cinerea Pers.	Grey mold	Bremer et al. (1948), Gürcan (1970)
Peperomia spp.	X Gloeosporium sp.	Leaf spot	
	X Septoria sp.	Leaf spot	
	X Botrytis sp.	Leaf blight.	
	X Ascochyta sp.	Leaf spot	
	X Rhizoctonia sp.	Root rot	Munnecke and Chandler (1953)
Pilea cadieri	X Gloeosporium sp.	Leaf spot	
Poinsettia sp.	X Botrytis cinerea Pers.	Leaf blight.	Blumer (1952)
	X Alternaria sp.	Leaf spot	

Host plants	Pathogens	Symptoms	Literatüre
Polyantes sp.	X Botrytis sp.	Leaf blight.	
Primula ekotor	Colletotrichum sp.	Leaf spot	Gürcan (1976)
Pseuderantheum atropurpureum	X Gloeosporium sp.	Leaf spot	
Punica sp.	X Ascochyta sp.	Leaf spot	
Rosa spp.	Sphaerotheca pannosa (Wallr.) Lev.	Powdery mildew	Bremer et al (1947)
	Diplocarpon rosae Wolf.	Black spot.	Bremer et al (1948)
	Phragmidium sp.	Rust.	Türkmenoğlu (1962)
	Alternaria sp.	Leaf spot	Sezgin et al (1973)
	X Perenospora sparse Berk.	Downy mildew	Baker (1953)
	X Pestalotia sp.	Leaf spot	
	Botrytis sp.	Bud, blossam and flower blight.	Türkmenoğlu (1962)
	X Phomopsis sp.	Stem canker	
Saint paulia	XX Colletotrichum destructor	Crown rot.	
	X Oidium sp.	Powdery mildew	Strider (1980)
Sanseveria spp.	Pleospora sp.	Leaf spot	Gürcan (1970)
	X Fusarium moniliforme Shel	Leaf spot	Gerlach (1959)
Scindapsus sp.	X Gloeosporium sp.	Leaf spot	
	X Pestalotia sp.	Leaf spot	
Sterlitzia sp.	X Botrytis sp.	Petal spot.	Orlikowski (1980)
Tulipa sp.	X Botrytis sp.	Blight	Bremer et al (1948)
	X Macrophomina sp.	Bulb rot	
Viburnum sp.	Microsphaera viburnii	Powdery mildew	Oran (1967)
Viola tricolar L.	Erysiphe cichoracearum	Powdery mildew	Gürcan (1970)

X : Fungi which were found on new host in Turkey

XX : Fungi recorded for the first time in Turkey

ÖZET

EGE BÖLGESİNDE TİCARİ AMAÇLA YETİŞTİRİLEN SÜS BİTKİLERİNDE SAPTANAN HASTALIKLAR

Ticari amaçla çiçek üretimi yapılan sera ve bahçelerde 1979-1980 yılları arasında yapılan surveyler sırasında çeşitli süs bitkilerinde saptanan hastalıkların listesi verilmiştir.

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Ege Üniversitesi Ziraat Fakültesi

Fitopatoloji ve Zirai Botanik Kürsüsü

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