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Die Unkrautdichte in der Umgebung vOn Erzurum im Getreideanbau und der NAehrstoffentzug durch einige Unkraeuter aus dem Boden

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ZUSAMMENFASSUNG

Die in der Umgebung von Erzurum im Getreideanbau vorhandenen Unkraeuter befinden sich hinsichtlich der Anzahl durchschnittlich (ø) ca. 75 Pflanzen je m^2. 18 Gattungen und 56 Arten von dieser Unkreuter konnten determiniert werden. Die übrigbleibenden 18 Arten sind noch nicht bestimmt. **Convolvulus arvensis** L. ist die am haeufigsten auftretende Unkrautart (ø je m^2 8,4). Danach folgen **Galium tricorne** Withering (7,1), **Chenopodium album** L. (5,1), **Cirsium arvense** Scop. (4,6), **Avena fatua** L. (4,4) und **Sinapis arvensis** L. (4,1). Die grösste Menge Stickstoff und Phosphor wird von **Rumex crispus** L. entzogen. Danach folgen **Anchusa italica** Retz., **Chondrilla juncea** L. und **Sonchus arvensis** L.. Die grösste Menge Kali entziehen **R. crispus, A. italica, Salsola kali** L. und **Stelleria kotschyana** Fenzl. In diesem Gebiet entziehen die Unkraeuter im Getreideanbau aus dem Boden ø ca. 56,6 Kg/ha Stickstoff, 22,2 Kg/ha Phosphor und 73,4 kg/ha Kali. Das bedeutet, dass die Unkraeuter in diesem Gebiet ca. mehr als einmal soviel Stickstoff, mehr als zweimal soviel Phosphor und doppelt soviel Kali entziehen, wie Getreidepflanzen..

EINLEITUNG

Die in der Umgebung von Erzurum im Getreideanbau befindlichen Unkraeuter wurden schon von Güncan (1972, 1975) nachgewiesen. In diesen Arbeiten wurden 59 Unkrautarten und 28 Gattungen bestimmt

und doch wurde in diesen Versuchen über Unkrautdichte (Abundanz) nicht in Kenntnis gesetzt. Mit dieser Arbeit wurde die Bestimmung der Unkrautdichte im Getreideanbau in der Umgebung von Erzurum und die Naehrstoffaufnahme einiger Unkraeuter aus dem Boden durch die chemische Analyse untersucht.

Durch die Unkraeuter wird den Nutzpflanzen ein grosser Teil der Naehrstoffe entzogen, die dem Boden durch Düngung zugeführt sind (Korsmo, 1930). Da viele Unkrautarten über ein sehr verzweigtes kraeftiges Wurzelsystem und sie also sehr starte Konkurrenten der Kulturpflanzen sind, vermögen die Unkraeuter die Naehrstoffe weit besser als die Kulturpflanzen auszunutzen.

In verschiedenen Laendern wurde über das Thema Naehrstoffentzug der Unkraeuter aus dem Boden beschaeftigt. Aber im Allgemeinen werden die örtlichen Unkraeuter in diesen Arbeiten untersucht und nach Kacar (1972) haengt die Naehrstoffaufnahme hauptsaechlich von ökologischen Bedingungen ab. Deshalb ist es in unserem Land notwendig gewesen, diese Arbeit durchzuführen. Durch die erzielten Erkenntnisse bei dieser Versuchsfolge wurden einige Frage über die Grundkenntnisse der Unkraeuter in unserem Land beantwortet.

MATERIAL UND METHODEN

Um die Dichte der an Getreideanlage vorhandenen Unkraeuter in der Umgebung von Erzurum festzustellen, wurde eine Vegetations-untersuchung nach "Teilende Modellverfahren" (Bora und Karaca, 1970) in den Jahren 1968-69 durchgeführt. Die Umgebung von Erzurum teilt sich nach der Methode in fünf verschiedenen Mikroklimateilgebieten. In diesen Teilgebieten ist ein m²'iger Musterreif verwendet, um die Unkrautdichte zu bestimmen. Die Zahl des Musterreifs haengt von der Verteilung der Unkraeuter und der Getreideflaeche in den Teilgebieten ab, bzw. je gleicher die Unkraeuter nicht verteilen und weiter die Getreideflaeche sind, desto mehr Musterreife verwendet wurden (Tab. 1).
Die festgestellten Ergebnisse wurden als durchschnittliche Unkrautzahl auf je m² dargestellt und die Naehrstoffaufnahme wurde nach der Unkrautdichte gerechnet.

Andererseits, in den Jahren 1976-77 wurden die an Tab. 6 dargestellten Unkraeuter im Getreideanbau in der Umgebung von Erzurum gesammelt, um den Naehrstoffgehalt der Unk-

Tab. 1. Die Zahl des verwendeten Musterreifs in den verschiedenen Mikroklimateilgebieten

Mikroklimateilgebieten	Zahl des Musterreifs
1. Erzurum-Aşkale	107
2. Pasinler-Horasan	71
3. Tortum-Oltu-Olur-Narman-Şenkaya	39
4. İspir	16
5. Tekman-Karayazı-Hınıs-Çat	18
Gesamt	251

raeuter zu bestimmen. Es wurde darauf geachtet, dass der Versuchsort gut verteilt mit Unkraeutern bedeckt ist. In diesem Ort wurden Unkrautproben (unterirdische- und oberirdische Teile der Pflanzen) waehrend der Blüte (Korsmo, 1930) von 9-30 Pflanzen gesammelt. Tiefwurzelnde Unkraeuter wurden bis 30 cm ausgegraben. Die unterirdischen und oberirdischen Teile der Unkraeuter wurden im Trockenschrank (bei 105°C) getrocknet und gemahlen. So wurde die Torckensubstanz bis 30 cm, anschliessend der Naehrstoffgehalt der Unkraeuter festgestellt. Da einige Unkraeuter sehr schwache unterirdische Teile bilden, konnten keine Proben für die Analyse in diesem Teil ausgegraben werden. Die getrockneten und gemahlenen Pflanzen-proben wurden nach der Methode von Kacar (1972) analysiert und die Menge von Stickstoff, Phosphor und Kali bestimmt. Der Aschegehalt der Unkraeuter wurde nach der Methode von Horwitz (1970) festgestellt.

Die analysierten Unkraeuter kann man als 63 % der vorhandenen Unkraeuter im Getreideanbau in der Umgebung von Erzurum bezeichnen. Also, die gesamten entziehenden Naehrstoffmengen der Unkraeuter wurden als theoretisch gerechnet, dadurch dass von den analysierten Unkraeutern erzielenden Ergebnisse zu den gesamten Unkrautzaehlen bzw. zu 100 % umgewandelt werden. Es ist sicher, dass diese Ergebnisse nicht ganz Sicher sind, sondern sie nur über Naehrstoffentzug in Kentniss setzen.

ERGEBNISSE UND DISKUSSION

Die Getreidebestaende in der Umgebung von Erzurum sind verunkrautet und hinsichtlich der Anzahl befinden auf dieser Anlage sich durchschinittlich (ø) 74,7 Unkrautpflanzen je m^2 Flaeche. 56 Arten und 18 Gattungen dieser Unkraeuter (73,5 Pflanzen je m^2) wurden determiniert. Die übriggebliebenen Unkraeuter (ø 1,3 Pflanzen je m^2) sind ca. 18 Arten und sie können noch nicht determiniert werden. Diese Unkrautarten befinden sich sehr selten in diesem Gebiet.

Die artbestimmten Unkraeuter wurden nach der Dichte in vier Gruppen geteilt (Tab. 2). Die erste Gruppe enthaelt 10 Unkrautarten, die in der Getreideanlage in diesem Gebiet am haeufigsten (2-9 Pflanzen je m^2) sind. Diese Unkraeuter sind hinsichtlich der Anzahl 59,45 % der gesamten Unkraeuter. Die zweite Gruppe (ø 1-2 Pflanzen je m^2) hat ebenso 10 Unkrautarten, die hinsichtlich der Anzahl 18,17 % der gesamten Unkraeuter sind. Die dritte Gruppe (ø 0,1-1 Pflanz je m^2) enthaelt 24 Unkrautarten, die 12,36 % der Unkraeuter sind. Die vierte Gruppe hat 15 Unkrautarten. Diese Unkraeuter sind hinsichtlich der Anzahl 0,53 % der gesamten Unkraeuter, bzw. diese Unkraeuter befinden sich in diesem Gebiet selten.

Die gattungbestimmten Unkraeuter wurden in eine Gruppe eingeordnet. 18 Unkrautgattungen sind in dieser Gruppe vorhanden und sie sind hinsichtlich der Anzahl 7,75 % der gesamten Unkraeuter (Tab. 3).

Die generativ und vegetativvermehrenden Unkraeuter, die im Allgemeinen mit den Getreidepflanzen stark konkurrieren, sind in die erste Gruppe eingeordnet (Tab. 2). Diese Unkraeuter vermehren sich rasch und passen sich der Getreideanlage an. Von dieser Gruppe ist die Ackerwinde (**Convolvulus arvensis** L.) hinsichtlich der Dichte die haeufigste Unkrautart (ø 8,4 Pflanzen je m^2). Die Vermehrung der Ackerkratzdistel (**Cirsium arvense** Scop) und Ackergaensedistel (**Sonchus arvensis** L.), die sich sowohl generativ als auch vegetativ vermehren, wird unter günstigen Klimabedingungen gefördert (Güncan, 1975; 1979 a; Özer, 1969). Deshalb sind diese Unkraeuter in der Umgebung von Erzurum weit verbreitet und sie gehören hinsichtlich der Dichte zur ersten Gruppe. Hornlebkraut (**Galium tricorne** Withering), Flughafer (**Avena fatua** L.), Vogelknöterich (**Polygonum aviculare** L.), Videnknöterich (**Polygonum convolvulus** L.) und Ackersenf (**Sinapis arvensis** L.), die sich nur durch Samen vermehren, vermischen we-

gen ihrer Samenformen in Getreidekorn und werden mit der Getreidesaat jedes Jahr in die Felder übertragen (Güncan, 1979 b). Deshalb treten sie in Getreidefeldern übermaessig auf und sie gehören somit zur ersten Gruppe. Hornlebkraut befindet sich hinsichtlich der Dichte an der Getreideanlage (ø 7,1 Pflanzen je m^2) in der zweiter Reihe der ersten Gruppe. Gelbkraut **(Boreava orientalis** Jaub et Spach), syrische Skabiose **(Cephalaria syriaca** L.) und zurückgekrümmter Amarant **(Amaranthus retroflexus** L.), die in anderen Umgebungen der Türkei sehr weit verbreitet sind, gehören in diesem Gebiet zur dritten Gruppe.

Nach der chemischen Analyse einiger Unkraeuter wurden festgestellt, dass die tiefwurzelnden und grossen Habitus besitzenden Unkraeuter, Stickstoff, Phosphor und Kali aus dem Boden mehr aufnahmen können. Krauser Ampfer **(Rumex crispus** L.), italienische Ochsenzunge **(Anchusa italica** Retz) grösser Krümling **(Chondrilla juncea** L.), Ackergaensedistel, gemeines Rohrschilf **(Phragmites communis** Trin.) und gelbe Wicke **(Vicia lutea** L.), die maehrjaehrigen und tiefwurzelnden Unkraeuter sind, entziehen nach der Reihe die grössten Mengen Stickstoff aus dem Boden der analysierten Unkraeuter (Tab. 4). Da diese Unkraeuter grosse Mengen Naehrstoff entziehen, sind sie wichtiger als mehr haeufigeren Unkraeuter. Kegel Leimkraut **(Silene conoidea** L.), Venus-Kamm **(Scandix pecten veneris** L.), weisser Gaensefuss **(Chenopodium album** L.) und zurückgekrümmter Amarant, die sich mit Samen vermehren und schwachen Habitus haben, entziehen die wenigsten Mengen Stickstoff der analysierten Unkraeuter. Die grössten Mengen Phosphor entziehenden Unkraeuter sind ebenso wie bei Stickstoff, krauser Ampfer, italienische Ochsenzunge, Ackergaen sedistel und grösser Krümling. Die kleinen Habitus besitzenden Unkraeuter wie weisser Gaensefuss, Kegel-Leimkraut, Hornlebkraut und Flughafer entziehen den wenigsten Phosphor. Acker-Schachtelhalm **(Equisetum arvense** L.) nimmt den Phosphor am wenigsten von den maehrjaehrigen Unkraeutern. Andererseits entziehen italienische Ochsenzunge, krauser Ampfer, Saltwort **(Salsola kali** L.) und eine Art von Sternkraut **(Stelleria kotschyana** Fenzl.) die grössten Mengen Kali von den analysierten Unkraeutern und Hornlebkraut, Acker-Schachtelhalm, Flughafer und Kegel Leimkraut entziehen am wenigsten (Tab. 4). Die Asche Ergebnisse sind in Tab. 4 zusammengefasst.

Wenn der Gehalt der Trockensubstanz an Naehrstoffen (Stickstoff, Phosphor und Kali) der Unkraeuter

Tab. 2. Die in der Umgebung von Erzurum in Getreideanbau vorhandenen Unkraeuter, deren Arten bestimmt wurden, und ihre Dichte

Reihe der Dichte	Unkrautarten	ø Anzahl (Pfllanz./m²)
	-Die erste Gruppe (ø 2-9 Pflanzen je m²)	
1	**Convolvulus arvensis**	8,375
2	**Galium tricorne**	7,120
3	**Chenopodium album**	5,120
4	**Cirsium arvense**	4,586
5	**Avena fatua**	4,410
6	**Sinapis arvensis**	4,092
7	**Polygonum aviculare**	3,056
8	**Stelleria kotschyana**	2,829
9	**Polygonum convolvulus**	2,801
10	**Sonchus arvensis**	2,036
	-Die zweite Gruppe (ø 1-2 Pflanzen je m²)	
11	**Setaria viridis**	1,514
12	**Cardaria draba**	1,482
13	**Stachys annua**	1,466
14	**Melilotus officinalis**	1,458
15	**Agropyron repens**	1,446
16	**Lamium amplexicaula**	1,426
17	**Tragopogon buphtalmoides**	1,398
18	**Polygonum persicaria**	1,363
19	**Amaranthus retroflexus**	1,012
20	**Geranium tuberosum**	1,008
	-Die dritte Gruppe (ø 1-0, 1 Pflanzen je m²)	
21	**Equisetum arvense**	0,940
22	**Agrostemma githago**	0,757
23	**Caucalis lathifolia**	0,749
24	**Vaccaria pyramidata**	0,582
25	**Boreava orientalis**	0,554

Tab. 2. (Fortsetzung)

Reihe der Dichte	Unkrautarten	ø Anzahl (Pfllanz./m²)
26	**Cephalaria syriaca**	0,486
27	**Fumaria officinalis**	0,462
28	**Phleum pratense**	0,458
29	**Anchusa italica**	0,454
30	**Centaurea cyanus**	0,446
31	**Ranunculus arvensis**	0,438
32	**Polygonum amphibium**	0,410
33	**Lotus corniculatus**	0,406
34	**Capsella bursa pastoris**	0,375
35	**Acroptilon picris**	0,323
36	**Falcaria vulgaris**	0,319
37	**Melampyrum arvense**	0,315
38	**Lactuca scariola**	0,239
39	**Matricaria inodora**	0,207
40	**Camelina hispida**	0,191
41	**Scandix pecten venedis**	0,124
	-Die vierte Gruppe (ø 0,001-0,1 Pflanzen je m²)	
42	**Sisymbrium sophia**	0,072
43	**Rumex crispus**	0,072
44	**Chondrilla juncea**	0,060
45	**Phragmites communis**	0,036
46	**Silene conoidea**	0,028
47	**Polygonum bellardii**	0,024
48	**Hyoscyamus niger**	0,016
49	**Papaver dubium**	0,016
50	**Cyondon doctylon**	0,016
51	**Centaurea solstitalis**	0,012
52	**Arctium lappa**	0,012
53	**Vicia tenuifolia**	0,008
54	**Eryngium campestre**	0,008
55	**Cichorium intybus**	0,008
56	**Cephalaria aristata**	0,004
Gesamt		67,625

Tab. 3. Die in der Umgebung von Erzurum im Getreideanbau vorhandenen Unkraeuter, deren Gattung bestimmt wurde und ihre Dichte. Anschliessend, die unbestimmten Unkraeuter

Reihe der Dichte	Unkrautgattung	ø Anzahl (Pflanz./m²)
1	**Vicia** spp.	2,96
2	**Medicago** spp.	0,805
3	**Salvia** spp.	0,693
4	**Agrostis** sp.	0,506
5	**Euphorbia** spp.	0,251
6	**Polygonum** sp.	0,136
7	**Linum** spp.	0,115
8	**Trifolium** spp.	0,092
9	**Poa** spp.	0,056
10	**Alyssum** spp.	0,044
11	**Bromus** spp.	0,040
12	**Onopordon** spp.	0,028
13	**Carduus** spp.	0,016
14	**Eringia** sp.	0,016
15	**Xeranthemum** sp.	0,008
16	**Adonis** spp.	0,008
17	**Urtica** spp.	0,004
18	**Plantago** spp.	0,004
Gesamt		5,790

-Die übriggebliebenen Unkraeuter (ø 1,3 Pflanzen je m²) sind ca. 18 Arten und sie können noch nicht determiniert werden.

Tab. 4. Chemische Zusammensetzung einiger Unkraeuter und Naehrstoffentzug in kg/ha durch Unkraeuter, wenn sie eine Pflanze je m² vorhanden ist

Unkrautart	Pflanzenteil	Trockenmasse (%)	Trockenmasse (kg/ha)	Stickstoff (%)
Allium rotundum	oberirdisch	38,33	42,33	0,80
	unterirdisch	—	—	—
Amaranthus retroflexus	oberirdisch	17,14	15,43	2,86
	unterirdisch	14,78	2,07	1,55
Anchusa italica	oberirdisch	18,49	246,00	2,20
	unterirdisch	8,97	31,43	0,80
Atriplex tartarica	oberirdisch	19,30	16,42	3,16
	unterirdisch	23,33	1,13	1,43
Avena fatua	oberirdisch	33,54	10,40	1,37
	unterirdisch	—	—	—
Cardaria draba	oberirdisch	33,50	73,70	1,43
	unterirdisch	37,41	11,17	1,39
Camelina hispida	oberirdisch	57,50	34,50	1,18
	unterirdisch	62,25	2,50	0,67
Centaurea cyanus	oberirdisch	35,92	53,88	1,29
	unterirdisch	35,29	3,33	0,41
Cephalaria aristata	oberirdisch	43,70	49,95	1,22
	unterirdisch	23,45	3,35	0,29
Cephalaria syriaca	oberirdisch	40,00	30,00	1,29
	unterirdisch	31,60	1,13	0,47
Chenopodium album	oberirdisch	14,16	10,20	3,23
	unterirdisch	13,07	0,85	1,49
Chondrilla juncea	oberirdisch	38,11	111,16	1,65
	unterirdisch	20,11	4,16	1,20
Cirsium arvense	oberirdisch	37,43	73,00	1,43
	unterirdisch	30,00	14,42	0,57
Consolida cornuta	oberirdisch	29,33	44,00	1,63
	unterirdisch	25,92	3,24	0,63
Convolvulus arvensis	oberirdisch	43,33	15,60	1,78
	unterirdisch	51,75	8,82	1,00

	Phosphor		Kali		Asche
(kg/ha)	(%)	(kg/ha)	(%)	(kg/ha)	(%)
0,339	0,50	0,212	1,02	0,432	8,50
—	—	—	—	—	—
0,460	1,20	0,199	3,54	0,620	28,54
	0,65		3,64		17,08
5,663	0,60	1,523	4,00	10,738	22,00
	0,15		2,86		15,78
0,535	0,90	0,152	4,80	0,813	27,68
	0,35		2.16		9,57
0,143	0,80	0,083	1,90	0,198	14,61
—	—	—	—	—	—
1,209	0,50	0,380	2,14	1,707	12,84
	0,10		1.16		4,32
0,424	0,75	0,266	1,60	0,587	14,18
	0,30		1,40		5,26
0,709	0,80	0,441	1,70	0,962	9,19
	0,30		1,22		5,17
0,419	0,60	0,303	1,22	0,638	6,93
	0,10		1,84		4,44
0,392	0,75	0,227	1,26	0,389	7,91
	0,15		0,94		4,29
0,342	0,70	0,076	4,80	0,511	26,89
	0,50		2,46		8,19
1,883	0,60	0,684	1,74	2,010	9,09
	0,40		1,72		9,96
1,126	0,70	0,533	2,20	1,860	11,99
	0,15		1,76		9,46
0,738	0,60	0,272	2,16	1,007	12,35
	0,25		1,76		6,47
0,287	0,75	0,130	1,82	0,392	14,36
	0,15		1,22		6,74

Tab. 4. (Fortsetzung)

Unkrautart	Pflanzenteil	Trockenmasse (%)	Trockenmasse (kg/ha)	Stickstoff (%)
Equisetum arvense	oberirdisch	48,06	8,48	1,25
	unterirdisch	—	—	—
Galium tricorne	oberirdisch	27,89	4,41	1,25
	unterirdisch	—	—	—
Matricaria inodora	oberirdisch	66,66	30,00	1,12
	unterirdisch	29,47	5,01	0,80
Melampyrum arvense	oberirdisch	48,58	65,40	1,39
	unterirdisch	—	—	—
Papaver dubium	oberirdisch	17,51	61,29	1,33
	unterirdisch	15,60	2,34	0,84
Phragmites communis	oberirdisch	59,95	86,93	1,55
	unterirdisch	51,17	13,38	0,49
Polygonum amphibium	oberirdisch	30,66	23,00	2,90
	unterirdisch	33,89	10,51	1,10
Polygonum persicaria	oberirdisch	19,35	30,00	2,61
	unterirdisch	—	—	—
Rumex crispus	oberirdisch	35,00	254,00	1,49
	unterirdisch	35,77	346,36	7,23
Salsola kali	oberirdisch	20,66	50,71	1,35
	unterirdisch	33,00	3,00	0,71
Scandix pecten veneris	oberirdisch	25,40	34,64	0,74
	unterirdisch	24,45	2,22	0,65
Silene conoidea	oberirdisch	38,69	14,83	0,90
	unterirdisch	37,38	0,81	0,29
Sinapis arvensis	oberirdisch	20,48	42,00	2,86
	unterirdisch	10,87	1,69	1,23
Sonchus arvensis	oberirdisch	22,15	87,50	1,49
	unterirdisch	31,44	29,92	0,55
Stelleria kotschyana	oberirdisch	16,03	56,11	2,18
	unterirdisch	21,00	1,65	6,29
Tragopogon buphtalmoides	unterirdisch	22,22	33,33	2,76
	unterirdisch	23,77	7,14	0,96
Vaccaria pyramidata	oberirdisch	45,71	57,14	1,27
	unterirdisch	21,80	1,56	0,35
Vicia lutea	oberirdisch	36,00	50,00	2,70
	unterirdisch	26,00	2,04	1,78
Vicia tenuifolia	oberirdisch	60,50	65,54	1,20
	unterirdisch	80,00	2,22	1,72
ø	oberirdisch		55,35	
	unterirdisch		18,48	

	Phosphor		Kali		Asche
(kg/ha)	(%)	(kg/ha)	(%)	(kg/ha)	(%)
0,106	0,40	0,034	1,54	0,131	24,66
—	—	—	—	—	—
0,055	0,60	0,026	1,70	0,075	10,49
—	—	—	—	—	—
0,376	0,95	0,303	1,80	0,618	17,45
	0,35		1,56		12,27
0,675	0,50	0,327	1,30	0,850	10,73
—	—	—	—	—	—
0,835	0,65	0,412	1,94	1,247	11,91
	0,60		2,46		10,63
1,413	0,35	0,317	1,10	1,071	8,84
	0,10		0,86		4,36
0,783	0,90	0,233	1,76	0,523	11,37
	0,25		1,14		8,81
0,783	0,90	0,270	2,64	0,792	26,14
—	—	—	—	—	—
28,826	0,65	2,517	1,88	7,130	9,53
	0,25		0,68		11,72
0,706	0,55	0,286	4,56	2,360	21,01
	0,25		1,60		6,79
0,271	0,40	0,146	2,28	0,777	20,08
	0,35		2,56		19,60
0,136	0,85	0,129	1,46	0,225	9,77
	0,30		1,06		4,41
1,222	1,15	0,496	2,00	0,875	17,00
	0,75		2,22		10,62
1,468	0,70	0,672	1,86	1,897	15,99
	0,20		0,90		8,04
1,327	1,15	0,649	4,14	2,344	22,34
	0,25		1,28		13,23
0,988	0,85	0,301	2,80	1,098	19,96
	0,25		2,24		8,66
0,731	0,85	0,490	1,36	0,791	7,83
	0,30		0,90		3,31
1,386	0,85	0,431	1,88	0,969	11,47
	0,30		1,42		12,18
0,694	0,45	0,299	0,66	0,444	8,99
	0,20		1,52		11,52
1,690		0,406		1,390	

mit Kulturpflanzen vergleicht wird, erscheinen interessante Ergebnisse. Tab. 5 zeigt, dass die Trockensubstanz der analysierten 11 Kulturpflanzen durchschnittlich 3,71% Stickstoff 0,29 % Phosphor und 1,91 % Kali enthaelt (Kacar, 1972; Klingman et al., 1975). Doch enthalten krauser Ampfer und Sternkraut doppelt soviel Stickstoff; zurückgekrümmter Amarant, Ackersenf und Sternkraut dreimal soviel Phosphor; italienische Ochsenzunge, weisser Gaensefuss, Tataren - Melde **(Atriplex tartarica** L.), Saltwort und Sternkraut dreimal soviel Kali, wie die erwaehnten Mittelwerte der 11 Kulturpflanzen. Dagegen enthalten einige Unkraeuter z.B. Rohrschilf und feinblatterige Wicke **(Vicia tenuifolia** Roth) weniger Naehrstoffe als die Kulturpflanzen.

Die Naehsstoffaufnahme der Unkraeuter aus dem Boden, die sich in Getreideanlage in der Umgebung von Erzurum befinden, wurde theoretisch umgerechnet. Die Ergebnisse sind in Tab. 6 zusammengestellt. Die Naehrstoffmengen der Unkraeuter haengen von den Arten und der Dichte ab. Bei

Tab. 5. Gehalt einiger Kulturpflanzen an Stickstoff, Phosphor und Kali (Zusammengestellt nach Angaben von Korsmo, 1930 und Klingman et al, 1975).

Kulturpflanzen	Gehalt der Trockensubstanz an Naehrstoffen (%) Stickstoff	Phosphor	Kali
Gerste	—	0,44	0,92
Weizen	2,00	0,24	3,40
Hafer	5,90	0,23	1,15
Mais	1,20	0,21	1,19
Bone	5,10	0,37	2,00
Wicke	—	0,36	—
Möhre	—	0,26	—
Baumwolle	5,00	0,32	1,13
Zuckerrüben	3,76	0,16	3,50
Kartoffel	3,00	0,25	2,95
Klee	—	0,35	1,00
ø	3,71	0,29	1,91

diesem Versuch wurde festgestellt, dass die Unkraeuter in Getreideanlage in diesem Gebiet ca. 56,6 kg/ha Stickstoff; ca. 22,2 kg/ha Phosphor und ca. 73,4 kg/ha Kali entziehen. Diese Rechnung wurde nach den oberirdischen und unterirdischen Teilen der Unkraeuter gemacht. Es soll jedoch in Rechnung gestellt werden, dass die unterirdischen Teilen der Unkraeuter im Boden bleiben und eine kleine Menge der entzogenen Naehrstoffe in den Boden nochmal zurückgehen. Andererseits fixieren die Hülsenfrüchteunkraeuter aus der Luft den Stickstoff. Doch nehmen die Unkraeuter die grossen Mengen Naehrstoffe aus dem Boden auf. Weniger (1973) zit. Wrangel hat ebenso mitgeteilt, dass die Getreidearten in der Höhe von 49 kg/ha Stickstoff, 9,6 kg/ha Phosphor und 39,1 kg/ha Kali entziehen (Tab.7). Das bedeutet, dass die Unkraeuter in der Getreideanlage in der Umgebung von Erzurum ca. mehr als einmal soviel Stickstoff, mehr als zweimal soviel Phosphor und doppelt soviel Kali wie Getreidepflanzen entzogen haben.

Aus diesen Versuchen geht klar hervor, dass durch die Unkraeuter den Nutzpflanzen ein grosser Teil der Naehrstoffe entzogen wird, die dem Boden durch Düngung zugeführt wurden. Ausserdem sollte man im Getreideanbau in der Umgebung von Erzurum Unkrautbekaempfung unbedingt durchgeführt werden, um die Naehrstoffe im Boden zu halten.

Dank

Herrn Doç. Dr. Turgut Sağlam und dem Laborant Mümtaz Şengül bedanke ich mich für die Unterstützung bei der Untersuchungen über die chemischen Analyse der Unkraeuter im Soil-Laboratorium.

Tab. 6. Wertstoffgehalt einiger Unkraeuter, die sich im Getreideanbau in der Umgebung von Erzurum befinden, in % und kg/ha

Unkrautarten	ø Anzahl (Pflanz./m²)	Trock.subs. (kg/ha)	Stickstoff (kg/ha)
Convolvulus arvensis	8,375	204,501	2,404
Galium tricorne	7,120	31,397	0,392
Chenopodium album	5,120	56,570	1,751
Cirsium arvense	4,586	400,873	5,164
Avena fatua	4,410	45,868	0,631
Sinapis arvensis	4,092	178,762	5,000
Stelleria kotschyana	2,829	163,386	3,754
Sonchus arvensis	2,036	239,055	2,989
Cardaria draba	1,482	125,786	1,792
Tragopogon buphtalmoides	1,398	56,593	1,382
Polygonum persicaria	1,363	40,875	1,067
Amaranthus retroflexus	1,012	17,708	0,466
Equisetum arvense	0,940	7,973	0,100
Vaccaria pyramidata	0,582	34,146	0,425
Cephalaria syriaca	0,486	15,132	0,191
Anchusa italica	0,454	126,009	2,572
Centaurea cyanus	0,446	25,527	0,316
Polygonum amphibium	0,410	13,753	0,321
Melampyrum arvense	0,315	20,581	0,212
Matricaria inodora	0,207	7,254	0,078
Camelina hispida	0,191	7,074	0,081
Scandix pecten veneris	0,124	4,552	0,034
Rumex crispus	0,072	43,046	2,067
Chondrilla juncea	0,060	6,885	0,113
Phragmites communis	0,036	3,601	0,051
Silene conoidea	0,028	0,436	0,004
Papaver dubium	0,016	1,012	0,013
Cephalaria aristata	0,004	0,213	0,002
Gesamt	44,064	1878,568	33,367
Umgewandelt(1) (zu 100%)	74,721	3185,503	56,581

1) Zu den auf je m² durchschnittlich gesamten Unkraeutern wurden umgewandelt.

Phosphor (kg/ha)	Kali (kg/ha)	Asche (kg/ha)
1,089	3,283	23,738
0,185	0,534	3,356
0,389	2,616	14,398
2,444	8,529	46,392
0,366	0,873	6,701
2,029	3,580	29,948
1,836	6,631	36,075
1,368	3,862	33,382
0,563	2,530	14,740
0,421	1,529	10,121
0,368	1,079	10,685
0,201	0,627	4,814
0,032	0,123	1,966
0,238	0,460	2,633
0,110	0,189	1,177
0,692	4,877	26,834
0,197	0,429	2,286
0,096	0,215	1,453
0,103	0,268	2,208
0,063	0,128	1,212
0,051	0,112	0,961
0,018	0,096	0,913
0,181	0,511	4,646
0,041	0,120	0,631
0,011	0,038	0,283
0,004	0,006	0,042
0,007	0,020	0,121
0,001	0,003	0,014
13,103	43,268	281,730
22,219	73,371	477,770

Tab. 7. Naehrstoffentzug in kg/ha durch Kulturpflanzen (Weniger, 1973 zir. Wrangel)

Kulturpflanzen	Naehrstoffentzug in kg/ha		
	Stickstoff	Phosphor	Kali
Getreide	49	9,6	39,1
Grünmais	102	18,3	14,2
Kartoffel	80	14,0	123,3
Zuckerrüben	120	21,8	145,8
Erbse	90	10,9	26,7
Klee	208	24,4	100,0
Wiesen-Kopfklee	100	13,1	50,0
Raps	122	28,4	62,5
ø	108,9	17,6	70,2

ÖZET

ERZURUM YÖRESİNDE HUBUBAT TARLALARINDA BULUNAN YABANCI OTLARIN YOĞUNLUĞU VE BUNLARDAN BAZILARININ TOPRAKTAN KALDIRDIKLARI BİTKİ BESİN ELEMENTLERİ

Erzurum yöresinde hububat tarlalarında bulunan yabancı otlardan 56'sının tür, 18'inin cins tanısı yaptırılmış, 18'inin ise henüz tanısı yaptırılamamıştır. Bölgede hububatta m^2 ye ortalama 75 adet yabancı ot bitkisi düşmektedir. Sayısal olarak en yoğun **Convolvulus arvensis** L. (m^2 de ortalama 8,4 adet), **Galium tricorne** Withering (7,1), **Chenopodium album** L. (5,1), **Cirsium arvense** Scop. (4,6), **Avena fatua** L. (4,4) ve **Sinapis arvensis** L. (4,1) bulunmaktadır. Kimyasal analizi yapılan yabancı otlar içerisinde en fazla N ve P kaldıranlar **Rumex crispus** L., **Anchusa italica** Retz., **Chondrilla juncea** L. ve **Sonchus arvensis** L.'dir. K'u en fazla kaldıran yabancı otlar ise **R. crispus** ve **A. italica** yanında **Salsola kali** L. ve **Stelleri kotschyana** Fenzl.'dir. Erzurum yöresinde hububatta yabancı otlar yaklaşık ortalama 56,6 kg/ha N; 22,2 kg/ha P ve 73,4 kg/ha K kaldırmakta, bu ise hububatın kaldırdığı N'un yaklaşık bir katından, P'un ise iki katından fazla, K'un ise takriben iki katıdır.

LİTERATURVERZEICHNIS

Bora, T. ve Karaca, İ. 1970. Kültür bitkilerinde hastalığın ve zararın ölçülmesi. Ege Üni. Yayınları.

Güncan, A. 1972. Erzurum çevresinde problem teşkil eden yabancı otlar ve bu bölgede isimlendirilmeleri. Ziraat Dergisi, Atatürk Üni. Ziraat Fak. 3(2): 15-21.

———. 1975. Erzurum çevresinde bulunan yabancı otlar ve önemlilerinden bazılarının yazlık hububatta mücadele imkânları üzerinde araştırmalar. Atatürk Üniv. Ziraat Fak. Yayınları No. 209.

———. 1979 a. Tarla sarmaşığı (**Convolvulus arvensis** L.)'nın biyolojisi ve buğday içerisinde mücadele imkânları üzerinde araştırmalar. Atatürk Üniv. Ziraat Fak. No. 234.

———. 1979 b. Türkiye'de buğday ürünü içerisine karışan yabancı ot tohumlarının bazılarının çimlenme biyolojisi üzerinde araştırmalar (Henüz basılmamıştır).

Horwitz, W. 1970. Official methods of analysis of the association of officinal analytical chemists., Association of Official Analytical Chemists, Benjamin Franklin Station, Washington 211 p.

Kacar, B. 1972. Bitki ve toprağın kimyasal analizleri II. Bitki analizleri Ankara Üniv. Ziraat Fak. Yayınları No. 453.

Klingman, C.G., Ashton, F.M. ve Noordhoff, L.J. 1975. Weed Science: Prenciples and practices. John Wiley and Sons, New York.

Korsmo, E. 1930. Unkraeuter im Ackerbau der Neuzeit. Julius Springer Verlag, Berlin.

Özer, Z. 1969. Untersuchungen zur Biologie und Bekaempfung der Ackerdistel (**Cirsium arvense** (L.) Scop.) Diss. Hohenheim.

Weniger, C. 1973. (Türkiye tarla kültürünün temelleri)! Menteş matbaası, İstanbul.

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Inclusion Bodies Produced by Bean Yellow Mosaic Virus Isolates in Broad Bean Plant[1]

Mehmet Asil YILMAZ[2] and Philip JONES[3]

ABSTRACT

Cytological investigation of Turkish Bean Yellow Mosaic Virus under electron microscope showed laminar, granular, membraneous and flexuous type of inclusion in the mesophyl cells of cytoplasma in broad bean leaves.

INTRODUCTION

Many viruses produce intracellular structures in the cytoplasm and organelles of the host plant as a result of infection. The characteristic morphology of this inclusion may be determined by the host (Esau and Hoffert 1971 a, b). However, in other cases, it is the virus which determines the size and shape of the inclusion (Edwardson, 1974).

Bean Yellow Mosaic Virus (BY MV), a virus of the potyvirus group, produces inclusions in the cytoplasm, nucleus and nucleolus of **Vicia faba** L. leaf cells, We have examined the inclusion bodies produced by three serologically identical strains of BY MV isolated from broad bean plants in Turkey, as a means of distinguishing between the isolates.

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3. Department of Plant Pathology, Rothamsted Experimental Station. Harpenden, Herts, England.

MATERIALS AND METHODS

Plant Material: The research was under taken at The Rothamsted Experimental Station. Field bean and french plants were grown in 4½" pots in a glasshouse and inoculated with the virus at the cotyledon stage. Samples were taken for electron microscopy when symptoms appeared (usually 2 weeks after inoculation).

Virus Material: Three isolates of BYMV were extracted from **Vicia faba** of Sakız, from the Çukurova region.

Electron Microscopy : Pieces of leaf tissue 1 x 2 nm fixed in a mixture of 2.5 % glutaraldehyde in 0.05 M. Cacodylate buffer pH 7.2 for 5 hours. They were then rinsed twice for 15 min in 0.05 M cacodylate buffer and post fixed in 2 % osmium tetroxide in 0.05 M cacodylate buffer overnight. The next morning the samples were rinsed for 15 min in the buffer and then dehydrated in a graded acetone series and embedded in Spurr's low viscosity embedding resin (Spurr, 1969). Ultrathin section were cut an a Reichert OMU - 4 Ultracut ultramicrotone, stained in the grid with uranyl acetate (20 min) and lead citrate (10 min) (Reynolds, 1963) and then examined in a Philips 201 electronmicroscope.

RESULTS

All the isolates produced inclusions of a laminar, granular type, in the cytoplasm of mesophyll cells of the broad bean plant (Figs 1-4). Isolate 1 also produced membraneous inclusion in these cells (Fig 1). Isolate 2 produced the longest laminar inclusions (3.600 nm) of all isolates (Fig 2), while isolate 3 induced flexous inclusions (Fig. 3).

DISCUSSION

Ultrastructural investigations of Turkish Bean Yellow Mosaic Virus infected broad bean plants reacted granular, laminar, membraneons and flexuous types of inclusion in the cytoplasm of the mesophyll cells, these inclusions are characteristic for BY MV infection (Christie and Edwardson, 1977).

BYMV can also induce inclusions in the nucleous, nucleolus (Mchorter 1941, 1965, 1965: Bos, 1970: Christie and Edwardson, 1977). We did not observe any nuclear or nucleolus inclusions in any of our sections.

The Morphology of the inclusion bodies may be different in serologically distinct viruses (Pratt, 1969). However, differences between induced inclusions in serologically identical viruses have not been reported. The three isolates reported here are serologically identical, and all induce two basic types of inclusion, the laminar and the granular. Differens in the size of the laminar inclusion occur in one isolates. Isolates 1 and 3 induce small laminar inclusion, while isolate 2 induces the longest (3.600 nm) laminar inclusions.

Membraneous type inclusion has been reported for a number of host-virus infections. Isolates 1 induced membraneous inclusions in broad bean leaf mesophyll cells, rather of the other isolates did. Flexous inclusions (not pinwheel) were evident in section of leaf infection of leaf infected fith isolate 3. Pinwheel of the types described by Edwardson (1974) were not seen in any of our sections although they are a common feature same virus infection by potyviruses.

The cell organelles remained remerkably normal. Bos (1969) reported that nuclear abnormalities were common in broad bean plants infected with his strain of BYMV, an Muller and Koenig (1965) observed that nucleolus inclusions could be used to distinquish different strains of BY MV. We have seen no abnormalities nuclei of inclusions of nuclei or inclusions of nucleoli induced by our strains of BYMV.

Key to Figures	
Chloroplast	C
Mitochandrion	M
Membraneous Inclusion Body	
Body	Me
Nucleous	N
Flexuous Inclusion Body	F
Laminar Inclusion Body	L
Granular Inclusion Body	Arrow

ÖZET

FASULYA SARILIK MOZAYİK VİRÜSÜNÜN BAKLA BİTKİSİ YAPRAKLARINDA OLUŞTURDUĞU HÜCRE CİSİMCİKLERİ

Fasulye Sarılık Mozayık Virüsü ile bulaşık bakla bitkisi yapraklarının elektron mikroskop altında incelenmesinde bu virüsün levha, granül, zarımsı ve eğri biçim de hücre cisimciklerini oluşturduğu saptanmıştır.

LITERATURE CITED

BOS, L. 1969. Inclusion bodies of Bean Yellow Mosaic Virus, some less known closely related viruses and Beet Mosaic Virus. Neth. J. Pl. Path. 75:137-143.

————. 1970. The identification of three new viruses isolated from wisteria and pisum in the Netherlands, and the problem of variation within the potato virus y group. Neth. J. Pl. Path. 76:8-46.

CHRISTIE, R.G. and J. EDWARDSON. 1977. Light and electron microscopy of plant virus inclusions. Florida Agricultural Experimental Station Monograph Series No:9, 155 pp.

EDWARDSON, J. 1974. Some properties of the potato virus y-group. Florida Agricultural Experimental Station Monograph Series No: 4, 398 pp.

ESAU, K. and L.L. HOEFFERT. 1971 a. Cytologyg of Beet Yellows virus infection in **Tetragonia** 1. paranchyma cells in infected leaf. Protoplasma 72: 255-273.

————. 1971 b. Cytology of Beet Yellow virus infection in **Tetragonia** II. vascular elements in infected leaf. Protoplasma 72:459-476.

MCHORTER, F.P. 1941. Isometrik crysals produced by pisum virus 2 and Phaseolus Virus 2. Phytopathology 31:760-761.

————. 1965. Plant Virus Inclusions. Annual Review of Phytopathology 3:287-312.

MULLER, W.C. and R. KOEING. 1965. Nuclear inclusion produced by Bean Yellow Mosaic Virus as indicators of cross protection Phytopathology 35: 242-243.

PRATT, M.J. 1966. Clover Yellow Vein Virus in North America. Plant Diseases Reporter. 53: 210-212.

REYNOLDS, E.S. 1963. The use of lead citrate at high pH as an electronopaque stain in electron microscopy. J. Cell Biology 17. p. 208.

SPURR, A.R. 1969. A low viscosity epoxy resin embedding medium for electron microscopy. J. Ultrastructural Research. 26. p. 31.

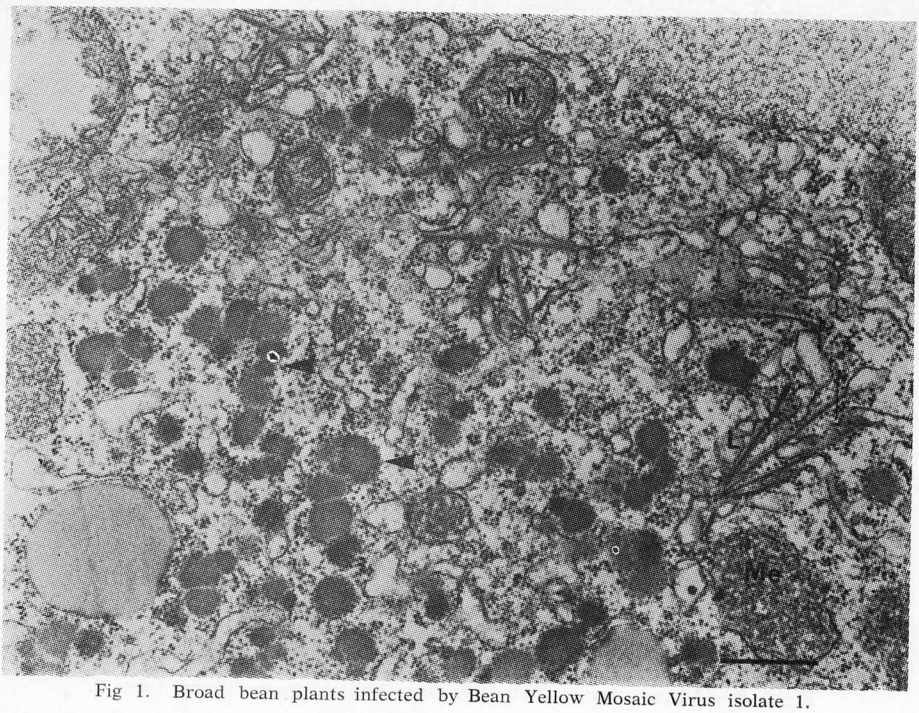

Fig 1. Broad bean plants infected by Bean Yellow Mosaic Virus isolate 1.
Bar indicates 0.5 nm.

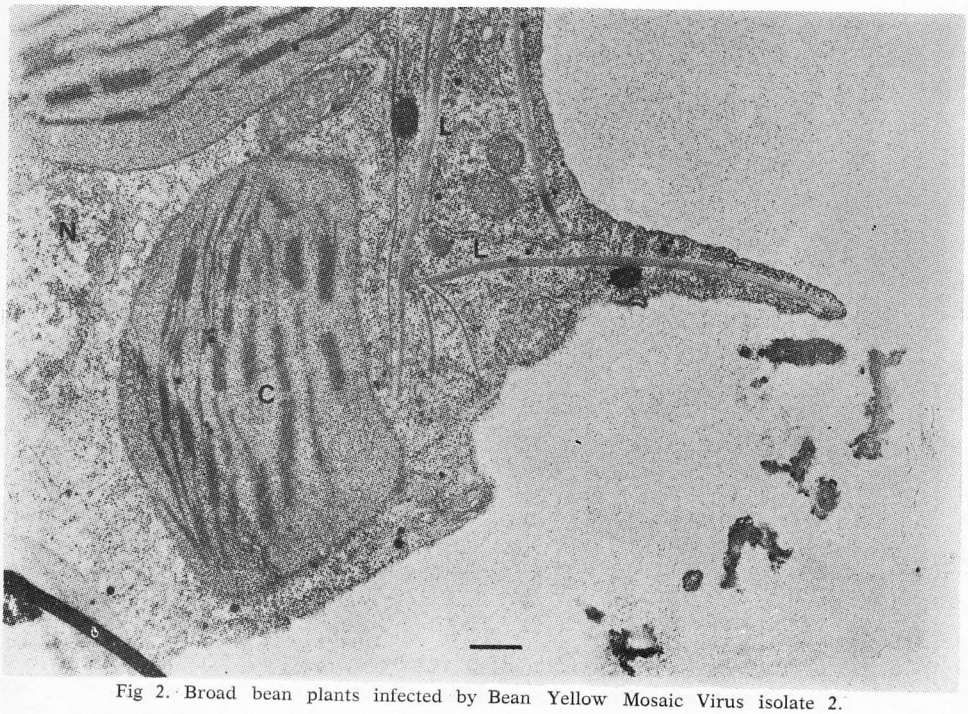

Fig 2. Broad bean plants infected by Bean Yellow Mosaic Virus isolate 2.
Bar indicates 0.5 nm.

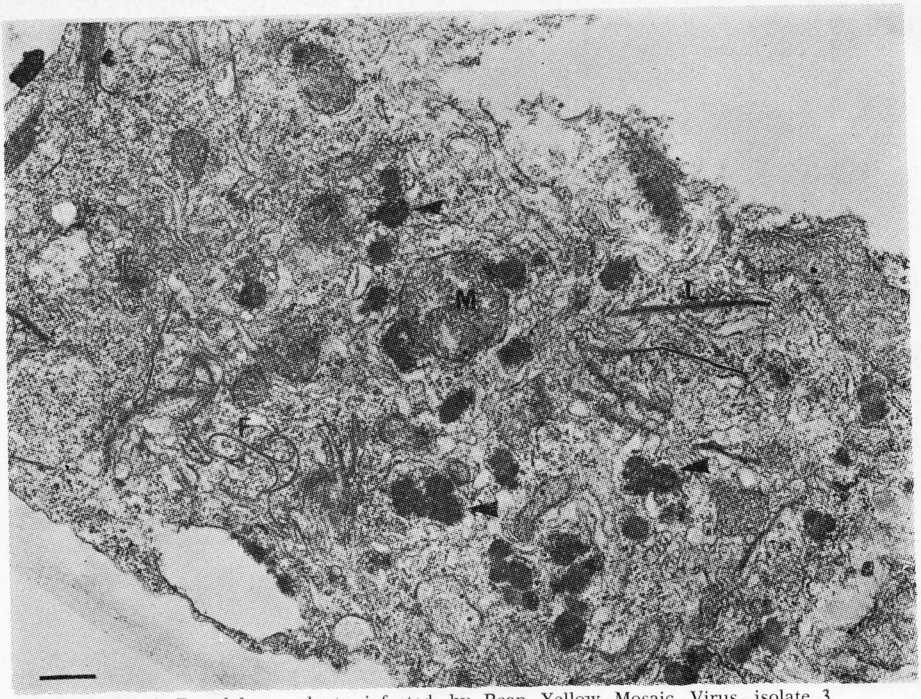

Fig 3. Broad bean plants infected by Bean Yellow Mosaic Virus isolate 3.
Bar indicates 0.5 nm.

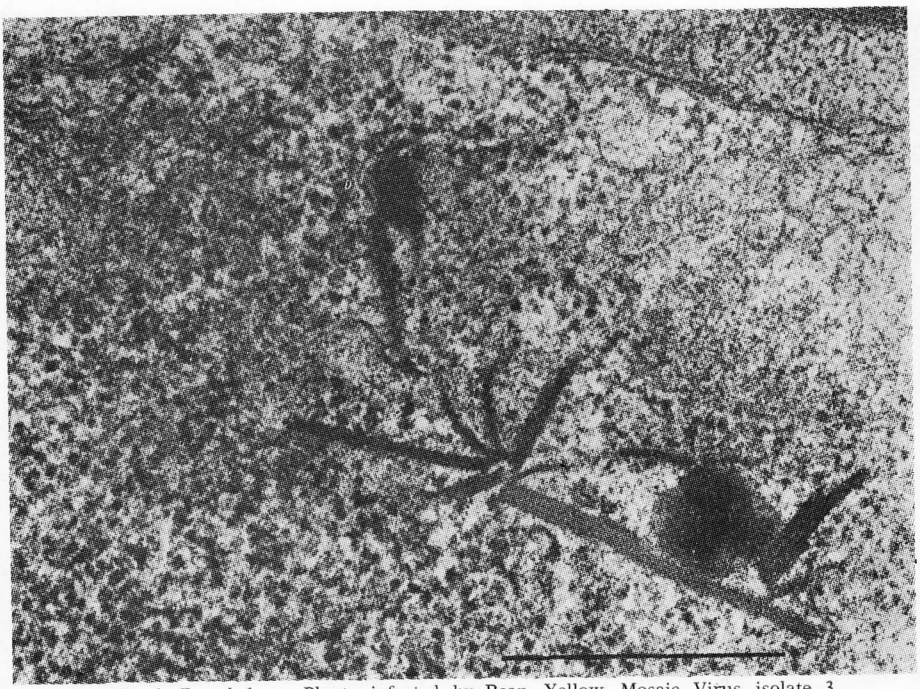

Fig 4. Broad bean Plants infected by Bean Yellow Mosaic Virus isolate 3.
Bar indicates 0.5 nm.

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Studies on the Control Possibilities of Chestnut Blight [Endothia parasitica (Murr.) A. and A.] in Turkey[1]

II. Appearance Possibility of Resistance After Continious Applications of Effective Systemic Fungicides Against the Pathogen **In Vitro**

Nafiz DELEN[2]

ABSTRACT

As the result of **in vitro** trainings it was determined that chestnut blight fungus **[Endothia parasitica** (Murr.) A. and A.] can acquire resistance against Benlate, Bavistin and Enovit Super which are the effective systemic fungicides to the pathogen. This acquired resistance is persistent and there is cross-resistance among the isolates but these isolates which acquired the resistance against the Benlate and Enovit Super showed a weaker development on Bavistin containing media. All three isolates showed a rapid development on Enovit Super containing media, contrarily the media containing other systemic fungicides.

INTRODUCTION

Chestnut blight **[Endothia parasitica** (Murr.) A. and A.] was found to be wide spread in Marmara and Black Sea Regions of Turkey (1,10,11, 18). In the earlier study, performed **in vitro** and greenhouse conditions,

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on the control possibilities of the pathogen by the systemic fungicides, it was found that Enovit Super (thiophanate-methyl) was the most effective chemical, and the effectiveness of this fungicide was followed by Bavistin (carbendazim) and Benlate (benomyl) respectively (12).

This study was performed **in vitro** conditions regarding the appearance possibility of resistant isolates of **E. parasitica** after the continious applications of the fungicides, the cross resistance among the resistant isolates and persistance of the acquired resistance.

MATERIALS AND METHODS

Materials

The fungicides included in the experiments, which were found to be active by Delen (12) are: Enovit Super [70 %, thiophanate-methyl (Sipcam s.p.A)], Bavistin [50 %, carbendazim = MBC (BASF A.G.)] and Benlate [50 %, benomyl (E.I. du Pont de Nemaurs and Co. Inc.)] from benzimidazole group.

Only in one test, European Chestnut (**Castanea sativa** Mill. = **C.vesca** Geartn.) seedlings were used.

The studies were performed with the single spor culture of **E.parasitica** used by Delen (10,12) and were not earlier treated with any chemicals.

Methods

Resistance acquiring possibility of the pathogen to the systemic chemicals were studied by the training method (2,6). For this purpose, the pathogen was trained six times on the fungicide mixed P.D.A. media (3) arranging at the twenty concentrations from 0,2 ppm level to 4.0 ppm. The inoculations were done by the discs of **E. parasitica.** After the twenty days period of the incubation the inoculum were takes from the highest concentrations by the needle because of the weak growth of the fungus, and were inoculated again to the same concentrations of the fungicides containing media. After first training, the evaluations were done on the basis of number of petri dishes with fungal growth for each fungicide series.

To show the importance of the our trained isolates in practice, a study were done by the method of Delen (12). For this study, at the end of the sixth training, every isolate was incubated for six weeks period on the media which was containing highest concentration of the chemical

causing the resistance. After this period, an inoculum containing 8×10^5 picnidiospor/ml for every isolate was prepared. These inocula were applied to the chestnut stem samples taken from the different heights of the plants drenched ten weeks before with Enovit Super, Bavistin and Benlate.

To investigate persistance of the acquired resistance, the method of Fuchs and Viets-Verwers (15) was applied. Every resistant isolate was transfered to the chemical free media and with the interval of twenty days these transfers were repeated six times which were equale to the number of the trainings. After the sixth transfer, the discs of the every isolate were inoculated to the media containing different levels of the fungicide causing the resistance.

For evaluating the occurance of cross - resistance among the isolates, two tests were done according to the methods of Littrell (19), Polach and Moline (23). In the first test, every resistant isolate was inoculated to the different levels of three fungicides begining from 0,2 ppm up to the resistance level of the every isolate. In the second experiment, the discs of the every isolate were taken from the highest concentration of the resistance caused fungicide. Then the discs were transfered to the media containing 1.0 - 4.0 ppm. concentrations of the chemicals. That concentrations were arranged according to the resistance level of every isolate.

After the cross-inoculation tests, every isolate was trained eight times totally. For exhibiting the resistance levels of the isolates and the persistance of the resistance, the logarithmic curves were prepared for every isolate. For drowing these curves, the logarithms of the half diameters, found out in the last measurement of the every test were used.

In all the tests no fungicide applied original isolate of **E. parasitica** were used as a control. The tests were conducted at randomized plot design with eight replications.

RESULTS

The result of the first training are given in Table 1.

According to the Table 1, colonial growth of the fungus was inhibited by Bavistin at 0.4 ppm., Benlate and Enovit Super at 0.6 ppm.

The results are depicted in Table 2, which show the number of petri dishes with fungal growth from 1st to 6th training at different concentrations of three fungicides used.

Table 1. Fungal growth of **E. parasitica** in the first training

Fungicide's		Measurement of colonial half diameter (mm.) days after application			
Trade Name	Concentration (ppm.,a.i)	2nd day	4th day	6th day	8th day
Benlate	0.2	0.16	1.44	2.58	3.93
	0.4	0.00	0.01	0.22	1.59
	0.6	0.00	0.00	0.00	0.00
Bavistin	0.2	0.09	0.32	1.12	1.70
	0.4	0.00	0.00	0.00	0.00
Enovit Super	0.2	1.02	8.38	16.02	22.37
	0.4	0.00	0.06	0.24	0.89
	0.6	0.00	0.00	0.00	0.00
Control	—	1.32	9.93	25.03	38.50

As it is shown in Table 2, after 6th training, pathogen acquired resistance to 2,4 ppm Enovit Super, 4.0 ppm Bavistin and 3.0 ppm Benlate concentrations.

After the sixth training, each resistant isolate and the original isolate was inoculated on the 10 weeks before drenched chestnut stem samples and were put in the petri dishes. Density of the fungal growth between the resistant isolates and the original one are given in the Table 3.

According to Table 3, the growth of the resistant isolates were more profuse than the original isolate on the chestnut seedling samples drenched with fungicides ten weeks before (Fig. 1,2 and 3).

Table 2. The appearance of the resistant isolates of the pathogen after six trainings of Enovit Super (EN), Bavistin (BAV), and Benlate (BEN)

Concent-	Number of the petri dishes which had the fungal growth																	
rations	1th Training			2nd Training			3th Training			4th. Training			5th. Training			6th. Training		
(ppm.,a.i)	EN	BAV	BEN	EN	BAV	BEN	EN	BAV	BEN	EN	BAV	BEN	EN	BAV	BEN	EN	BAV	BEN
0.2	8	3	6	8	3	8	8	8	8	8	8	8	8	8	8	8	8	8
0.4	3		4	5		4	8		4	8	6	8	8	8	8	8	8	8
0.6							6		3	8	6	8	8	8	8	8	8	8
0.8							4		1	6	6	6	8	8	8	8	8	8
1.0							4			6	4	5	8	6	8	8	8	8
1.2													6	6	8	8	8	8
1.4													6	6	8	8	8	8
1.6													3	2	4	8	8	8
1.8																8	8	8
2.0																8	8	8
2.2																6	8	8
2.4																3	8	6
2.6																	8	6
2.8																	8	6
3.0																	8	4
3.2																	8	
3.4																	8	
3.6																	8	
3.8																	8	
4.0																	8	

Table 3. Fungal growth of the resistant isolates and the original isolate of the pathogen on the 10 weeks before treated chestnut stem samples taken from the different heights of the seedlings.

Fungicide's		The heights of	Trade name of the resis-	Percentages of the fungal growth	
Trade Name	Concentration (ppm., a.i)	the samples from the soil (cm)	tance caused fungicide	Resistant isolate	Original isolate
Benlate	3000	0.0 — 4.5	Benlate	41.22	0.00
		29.5 — 34.0		83.37	6.62
		59.0 — 63.5		100.00	8.26
	4500	0.0 — 4.5		40.00	1.27
		29.5 — 34.0		100.00	16.28
		59.0 — 63.5		100.00	23.92
Bavistin	3000	0.0 — 4.5	Bavistin	100.00	0.00
		29.5 — 34.0		100.00	8.19
		59.0 — 63.5		100.00	5.70
	4500	0.0 — 4.5		47.38	0.00
		29.5 — 34.0		98.30	6.96
		59.0 — 63.5		100.00	0.00
Enovit Super	3000	0.0 — 4.5	Enovit Super	36.53	3.14
		29.5 — 34.0		100.00	2.13
		59.0 — 63.5		100.00	12.35
	4500	0.0 — 4.5		25.00	0.00
		29.5 — 34.0		70.21	0.00
		59.0 — 63.5		76.24	0.00
Control	—	0.0 — 4.5	—	—	100.00
		29.5 — 34.0		—	100.00
		59.0 — 63.5		—	100.00

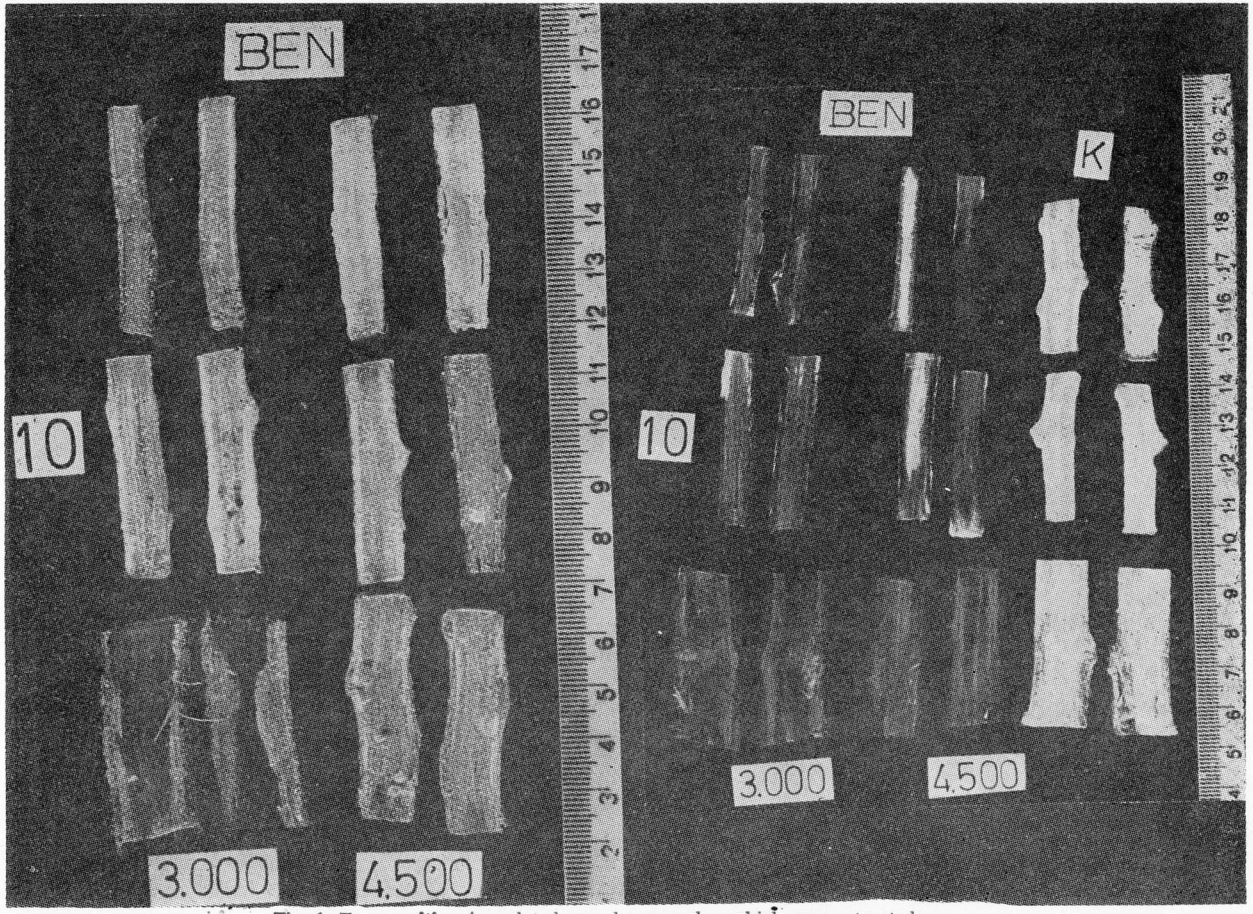

Fig. 1. **E. parasitica** inoculated wooden samples which were treated ten weeks before with 3000 and 4500 ppm Benlate (BEN) (Resistant isolate at the left side, original isolate at the right side. The rows of the samples are indicating each height. K : Control).

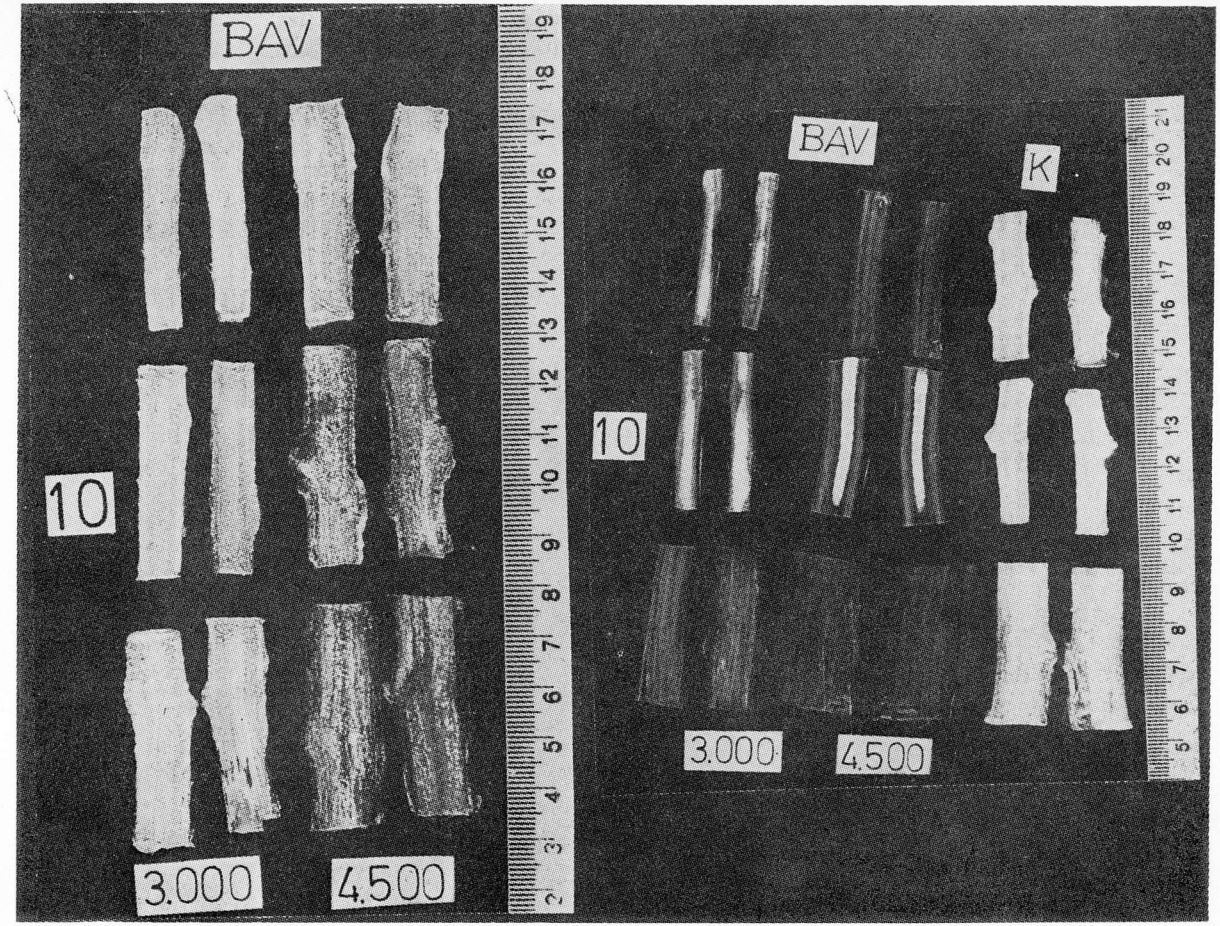

Fig. 2. **E. parasitica** inoculated wooden samples which were treated ten weeks before with 3000 and 4500 ppm Bavistin (BAV) (Resistant islate at the left side, original isolate at the right side. The rows of the samples are indicating each height. **K** : Control)

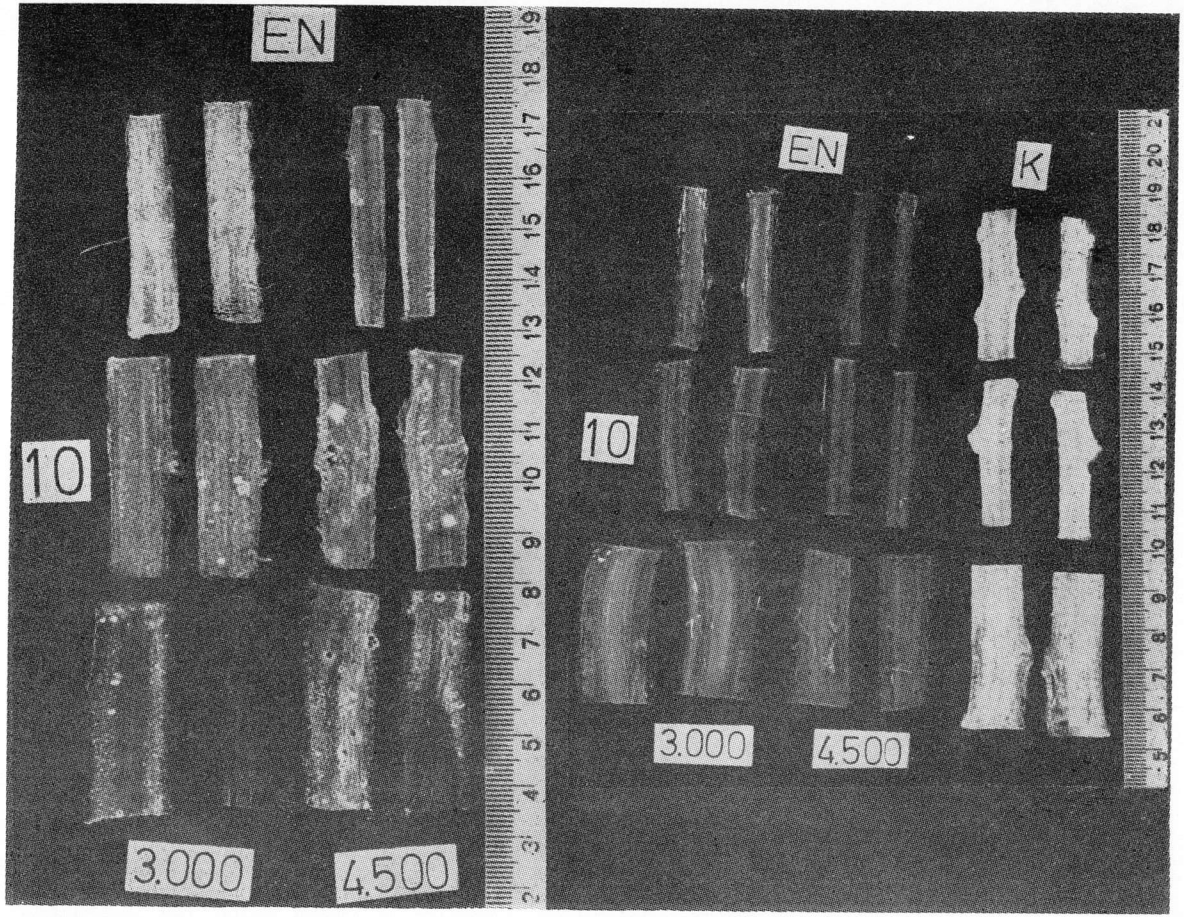

Fig. 3. **E. parasitica** inoculated wooden samples which were treated ten weeks before with 3000 and 4500 ppm. Enovit Super (EN) (Resistant isolate at the left side, original isolate at the right side. The rows of the samples are indicating each height. **K** : Control).

The results of the first cross-resistance test among the isolates are summerized in the Table 4.

Table 4. In the first cross-resistance test, measured colonial half diameters of Benlate, Bavistin and Enovit Super resistant isolates.

Trade name of the fungicide, causing the resistance	Applied fungicide's Trade name	Concentration (ppm., a.i)	Measurement of colonial half diameter (mm) days after application 2nd	4th	6th	8th
Benlate	Benlate	0.2	0.28	0.90	1.93	3.57
		0.4	0.12	0.34	0.89	2.20
		0.6	0.06	0.23	0.49	1.50
		0.8	0.03	0.20	0.46	0.93
		1.0	0.01	0.18	0.43	0.75
		3.0	0.00	0.00	0.06	0.28
Benlate	Bavistin	0.2	0.26	0.65	0.76	1.49
		0.4	0.10	0.40	0.56	0.70
		0.6	0.00	0.15	0.45	0.70
		0.8	0.00	0.10	0.32	0.56
		1.0	0.00	0.03	0.14	0.20
		4.0	0.00	0.04	0.10	0.21
Benlate	Enovit Super	0.2	1.15	5.30	7.90	9.96
		0.4	1.02	4.32	6.21	8.84
		0.6	0.99	4.18	6.18	7.59
		0.8	0.84	3.41	5.25	7.00
		1.0	0.41	2.75	3.70	5.31
		2.4	0.21	0.59	1.04	1.35
Bavistin	Bavistin	0.2	1.23	4.01	5.15	6.40
		0.4	0.13	0.35	1.21	3.65
		0.6	0.09	0.25	0.65	1.46
		0.8	0.06	0.21	0.56	1.17
		1.0	0.01	0.12	0.51	0.93
		4.0	0.00	0.10	0.21	0.34

Table 4. (Continuening). In the first cross resistance test, measured colonial half diameters of Benlate, Bavistin and Enovit Super resistant isolates

Bavistin	Benlate	0.2	1.16	4.40	5.40	7.34
		0.4	0.71	3.32	4.18	5.40
		0.6	0.24	0.96	1.85	3.28
		0.8	0.07	0.52	1.34	2.78
		1.0	0.01	0.10	0.31	0.99
		3.0	0.00	0.00	0.00	0.01
Bavistin	Enovit Super	0.2	1.35	9.28	19.65	30.50
		0.4	0.60	7.59	9.62	11.72
		0.6	1.21	7.66	8.68	10.03
		0.8	1.17	4.96	5.95	7.65
		1.0	0.74	4.54	5.95	7.37
		2.4	0.74	4.49	5.90	6.90
Enovit Super	Enovit Super	0.2	2.48	8.39	16.30	25.90
		0.4	2.40	5.92	7.81	10.43
		0.6	1.28	5.09	6.65	7.59
		0.8	1.03	4.54	6.46	7.56
		1.0	1.02	3.40	4.65	5.53
		2.4	0.62	2.04	2.70	3.21
Enovit Super	Benlate	0.2	0.29	0.85	1.96	3.71
		0.4	0.01	0.20	0.60	1.04
		0.6	0.01	0.09	0.24	0.42
		0.8	0.00	0.07	0.18	0.28
		1.0	0.00	0.03	0.20	0.21
		3.0	0.00	0.00	0.00	0.00
Enovit Super	Bavistin	0.2	0.03	0.18	0.37	0.53
		0.4	0.00	0.06	0.31	0.34
		0.6	0.00	0.04	0.15	0.23
		0.8	0.00	0.04	0.12	0.14
		1.0	0.00	0.00	0.03	0.04
		4.0	0.00	0.00	0.03	0.04
Control	—	—	1.35	11.32	20.64	38.41

According to Table 4, although the resistant isolates grew rapidly on the media containing Enovit Super, they showed a weaker development on the media containing Bavistin. More over, Bavistin resistant isolate was the most rapid growing one. On the basis of statistical analyses; isolates, fungicides, concentrations, isolates x chemicals and isolates x concentrations were found out to be significantly important ($P<0.001$).

The results of the second cross-resistance test performed at 1.0 ppm to 4.0 ppm concentrations is shown in Table 5.

Table 5. Colonial growth of Benlate, Bavistin and Enovit Super resistant isolates in the second cross-resistance test.

Trade name of the fungicide, causing the resistance	Applied fungicide's		Measurement of colonial half diameter (mm) days after application			
	Trade name	Concentration (ppm., a.i)	2nd	4th	6th	8th
Benlate	Benlate	1.0	0.95	5.85	10.12	13.65
		2.4	0.77	3.57	5.02	7.32
		3.0	0.54	2.68	3.73	4.43
		4.0	0.27	2.28	3.15	3.66
Benlate	Bavistin	1.0	1.13	6.59	10.68	14.03
		2.4	0.78	3.67	5.07	6.96
		3.0	0.68	2.85	3.15	4.21
		4.0	0.60	1.37	1.63	2.15
Benlate	Enovit Super	1.0	1.24	6.87	9.78	13.57
		2.4	0.74	5.60	8.14	9.79
		3.0	0.74	4.20	6.24	7.82
		4.0	0.67	4.18	5.65	7.21
Bavistin	Bavistin	1.0	1.34	8.84	16.65	21.81
		2.4	0.92	6.03	9.18	11.53
		3.0	0.88	3.81	6.03	7.31
		4.0	0.40	2.57	3.65	5.49

Table 5. (Continuening). Colonial growth of Benlate, Bavistin and Enovit Super resistant isolates in the second cross-resistance test

Bavistin	Benlate	1.0	1.14	8.40	13.37	17.90
		2.4	1.04	5.70	7.70	10.78
		3.0	0.96	3.87	4.77	6.35
		4.0	0.65	4.81	4.65	6.10
Bavistin	Enovit Super	1.0	1.45	7.81	10.65	16.55
		2.4	1.43	6.34	9.23	12.31
		3.0	1.01	6.09	7.90	10.59
		4.0	0.95	5.82	7.84	10.53
Enovit Super	Enovit Super	1.0	0.93	5.28	7.93	9.46
		2.4	0.92	3.71	5.84	7.68
		3.0	0.51	3.43	5.49	6.38
		4.0	0.49	3.28	4.54	5.46
Enovit Super	Benlate	1.0	1.17	4.21	5.98	7.73
		2.4	0.67	1.48	3.02	3.87
		3.0	0.21	0.31	0.48	0.73
		4.0	0.00	0.00	0.00	0.56
Enovit Super	Bavistin	1.0	0.46	5.37	7.43	9.90
		2.4	0.00	0.00	0.00	0.00
		3.0	0.00	0.00	0.00	0.00
		4.0	0.00	0.00	0.00	0.00
Control		—	1.40	12.00	22.05	39.53

According to the Table 5, all the resistant isolates grew most rapidly on Enovit Super containing media, Enovit Super resistant isolate grew more slowly than the other two resistant isolates. On the basis of the statistical analysis; fungicides, concentrations, fungicides x concentrations were found out to be significantly important ($P<0.001$).

For obtaining the persistance of the acquired resistance, firstly resis-

tant isolates were transfered to the fungicide free media equal to the training numbers. After these transfers, each isolate was inoculated to the media which were containing fungicide which caused resistance. Growth of the isolates on the fungicide containing media are given in the Table 6.

Table 6. After six training on the fungicide free media, growth of the resistant isolates on the media, containing fungicides which caused resistance

Trade name of the fungicide, causing the resistance	Applied fungicide's		Measurement of colonial half diameter (mm) days after application			
	Trade name	Concentration (ppm., a.i)	2nd	4th	6th	8th
Benlate	Benlate	0.2	0.56	5.46	11.31	15.78
		0.4	0.56	4.21	8.39	12.28
		0.6	0.53	3.64	6.51	9.09
		0.8	0.51	2.13	5.24	6.40
		1.0	0.48	1.15	3.81	5.79
		3.0	0.00	0.00	0.12	0.20
Bavistin	Bavistin	0.2	1.31	8.54	17.31	28.34
		0.4	0.93	8.00	15.93	25.68
		0.6	0.57	7.14	14.78	24.91
		0.8	0.56	5.25	13.56	21.51
		1.0	0.54	5.15	11.93	19.63
		4.0	0.00	0.96	2.56	4.71
Enovit Super	Enovit Super	0.2	0.84	7.03	13.92	25.90
		0.4	0.78	5.01	8.42	15.16
		0.6	0.67	4.50	7.00	11.50
		0.8	0.54	3.96	6.97	10.38
		1.0	0.52	3.89	6.85	9.48
		2.4	0.28	3.68	6.33	8.87
Control	—	—	1.10	9.47	20.43	34.60

According to the table, every isolate persisted their resistance level. Bavistin resistant isolate grew more rapidly on the Bavistin containing media, but Benlate resistant isolate grew more slowly on the Benlate containing media than the other two isolates. On the basis of the statistical analysis; fungicides, concentrations, fungicides x concentration found out to be significantly important ($P < 0.001$).

Acquirance and the persistance of the resistance for every isolate were shown as a logarithmic curves in the Figures 4,5 and 6.

DISCUSSION

As a result of this study it was determined that, the pathogen can acquire resistance against Enovit Super, Bavistin and Benlate which had been found out as effective systemic fungicides by Delen (12). Dekker (6, 7) and Fehrmann (13) stated that, the fungi can acquire resistance as a result of the continious applications of the systemic fungicides from benzimidazole group. Appearance of the resistant isolates of a fungus **in vitro** did not indicate that the resistance will also appear in the nature (8). But, resistance is more easily acquired in the laboratory conditions (16), and because the resistance can be acquired very slowly in the nature and the appearance time of the resistant isolates can not be determined (22), so laboratory tests can give us knowledge on the appearance possibitly of the resistance (16). Resistance acquiring abitily of **E.parasitica in vitro** do indicate that, the resistant isolates of the pathogen can also appear in the nature, in a short period after the continious applications of the mentioned fungicides.

The study which was performed to obtain the importance of the resistant isolates for controling purpose of the pathogen, all the growth of the resistant isolates were more profuse than the original isolate on the chestnut stem samples. The similar results were also taken from the resistant isolates of **Erysipha graminis**, and ten times higher fungicide concentration were needed than the suscebtible isolate for controlling the resistant isolates (31.32). Our result and the mentioned literatures are showing the importance of the possible occurance of the resistant isolates of **E. parasitica** in nature.

Carbendazim which is the degradation product of Enovit Super and Benlate, and the active ingradient of Bavistin cause resistance in the fungi

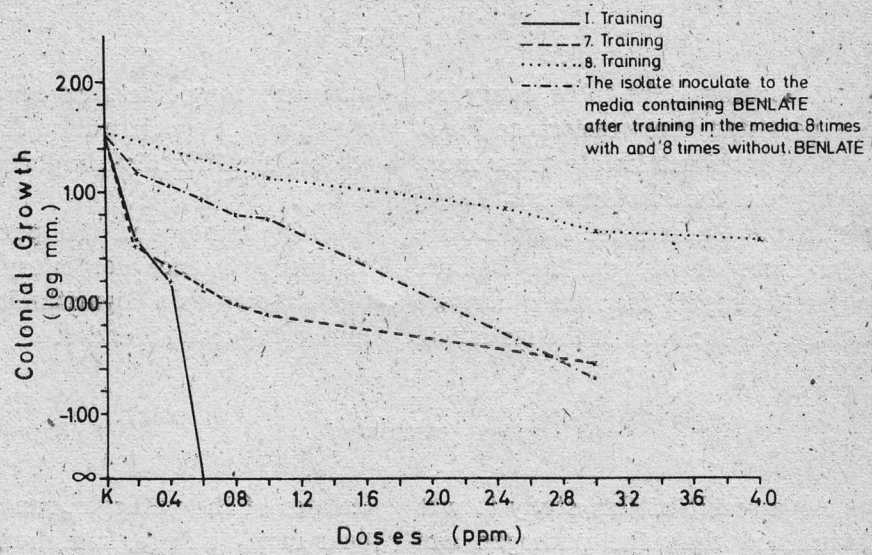

Fig. 4. Acquirance the resistance against Benlate and its persistance in the form of logarithmic curve.

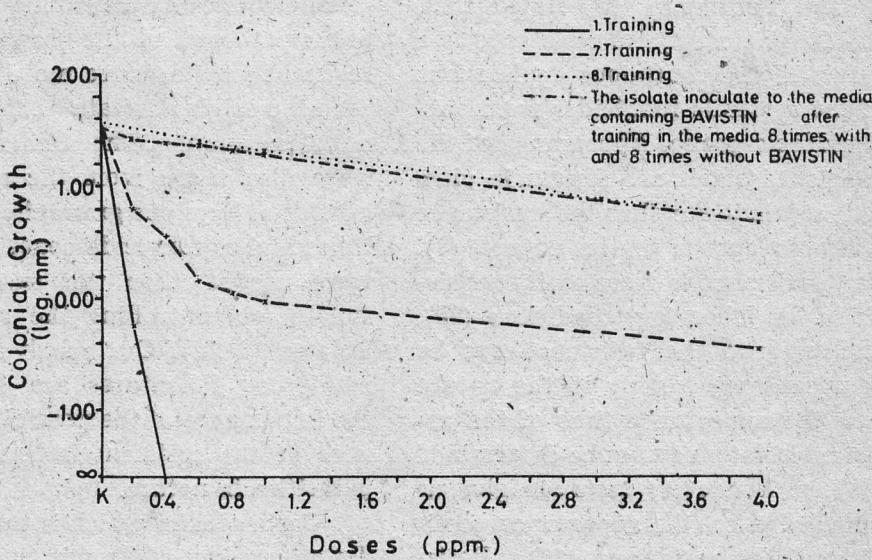

Fig. 5. Acquirance the resistance against Bavistin and its persistance in the form of logarithmic curve.

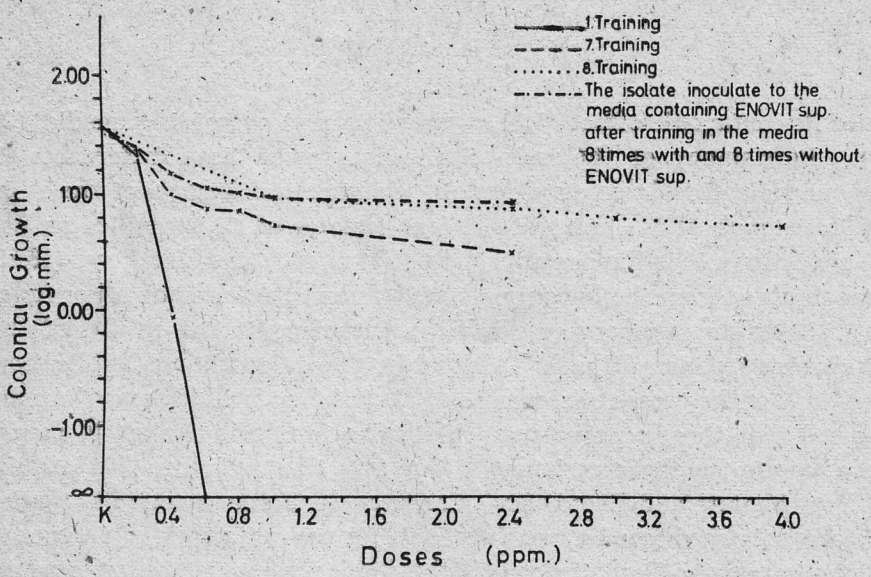

Fig. 6. Acquirance the resistance against Enovit Super and its persistance in the form of logarithmic curve.

because of its mutagenic effect (5,14, 24,25,26). Persistancy of the resistance in our trained isolates may be also the resistance of **E. parasitica** due to mutations. Similar results were also obtained from the benomyl resistant **Fusarium oxysporum** and **Botrytis cinerea** isolates (21).

The result of the cross-resistance tests showed that, these exists cross-resistance among the three resistant isolates. But, Benlate and Enovit Super resistant isolates showed a weaker development on the Bavistin containing media. All three isolates developed rapidly on Enovit Super containing media. Georgopoulos (16) stated that, there is cross-resistance among the analog compounds. Cross-resistance among the benzimidazole derivatives were also confirmed by Georgopoulos and Dovas (17), Bollen and Van Zaayen (4). But, some differences were obtained between the benzimidazole group fungicides from the respect of cross- resistance (3,27). Although rapid development of the Bavistin and Benlate resistant isolates of **E. parasitica** on the thiophanate - methyl containing media and weaker development on the Benlate containing media are being confirmed by the results of the above mentioned studies, however the differences are between the development speed of resistant isolates on the Enovit Super containing media and on the Benomyl containing media (3). The reasons of these differences lie in the genetical aspects of the resistant isolates of **E. parasitica** as Van Tuyl et al (30) and Van Tuyl (28,29) have found out for some other fungi.

According to the results of this study, due to continious applications of Enovit Super which was the most effective fungicide against **E. parasitica** (12), the pathogen can acquire resistance. Some authors suggested that, for preventing the resistance, the high doses must be selected instead of the lowers, the number of the applications must be decreased, the effective systemic fungicides which have different mode of actions must be used in rotation, and the resistance must be obtained in the earliest time by the continious observations and tests (8,9,20). To control the chestnut blight, some of the above mentioned measures can be applied for preventing the appearance of the resistant isolates to the effective fungicides. But for practical control of the disease another active chemicals from the different groups must be found out for using in rotation with Enovit Super, and the problems put forth by the author in an earlier study (12) should also be taken into consideration.

This is the first report on the resistance of **E. parasitica** against the systemic fungicides.

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ÖZET

KESTANE KANSERİ [**Endothia parasitica** (Murr.) A. and A.] İLE SAVAŞ OLANAKLARI ÜZERİNDE ARAŞTIRMALAR

II. Pathogen'e Karşı Etkili Sistemik Fungisidlerin Sürekli Kullanılması Sonucu **In Vitro**'da Dayanıklılığın Ortaya Çıkabilme Olasılığı

Kültür koşullarında yapılan araştırmalar sonucu, kestane kanseri hastalığını önlemede etkili bulunmuş olan Enovit Super, Bavistin ve Benlate'e etmenin dayanıklılık kazanabileceği saptanmıştır. Kazanılan bu dayanıklılık hastalıkla savaş açısından da önemli olup, adı geçen fungisidlerle ilaçlanmış kestane fidanlarından alınan gövde parçalarında, patojenin orijinal izolatına oranla dayanıklılık kazanmış izolatları, dayanıklılık kazandıkları fungisidlerden daha az etkilenmişlerdir.

Ayrıca, kazanılan dayanıklılık kalıcı olup, izolatlar arasında çapraz dayanıklılık da bulunmaktadır. Ancak, Benlate ve Enovit Super'e dayanıklılık kazanan izolatlar, Bavistin içeren besiyerinde daha zayıf gelişme göstermişlerdir. Enovit Super içeren besiyerinde ise, her üç izolatta, diğer sistemikleri içeren besiyerlerinin aksine, en hızlı biçimde gelişmişlerdir.

LITERATURE CITED

1. AKDOĞAN, S. ve E. ERKAM, 1968. Dikkat Kestane Kanseri görüldü. Tomurcuk, (1):4-5.
2. BEN-YEPHET, Y., Y. HENIS and A. DINOOR, 1975. Inheritance of tolerance to carboxin and benomyl in **Ustilago hordei**. Phytopathology, **65**:563-567.
3. BOLLEN, G.J., 1971. Resistance to benomyl and some chemically related compounds in strain of **Penicillium** species. Neth. J. Pl. Path., **77**:187-193.
4. ———— and A. VAN ZAAYEN, 1975. Resistance to benzimidazole fungicides in pathogenic strains of **Verticillium fungicola**. Neth. J. Pl. Path. **81**:157-167.
5. DAVIDSE, L.C. and W. FLACH, 1976. Selectivity of benzimidazole compounds. Abstracts,

Symposium on Internal Therapy of Plants, Wageningen The Netherlands, P:7.

6. DEKKER, J., 1972. "Resistance" Systemic Fungicides, 156-174. Eds.: R.W. Marsh, R.J.W. Byrde and D. Woodcock. Longman Group Ltd. London.

7. ————————, 1973. Selectivity of and resistance against systemic fungicides. EPPO Bul. No: 10: 47-57.

8. ————————, 1976. Prostects for the use of systemic fungicides in view of the resistance problem. Symposium on the Resistance of Plant Pathogens to chemicals, 47-53. **"In"** Proceedings of the American Phytopathological Society, Vol: 3.

9. ————————, 1977. The fungicide-resistance problem. Neth. J.Pl.Path. **83**(Suppl.1):159-167.

10. DELEN, N., 1975. Distribution and the biology of Chestnut Blight [**Endothia parasitica** (Murrill) Anderson and Anderson] J. Turkish Phytopath. **4**:93-113.

11. ————————, 1979. Studies on Chestnut Blight [**Endothia parasitica** (Murr.) A. and A.] in Turkey. Papers of the 6th Interbalkanic Plant Protection Conference, 10-16. October, 1977 İzmir-TURKEY.
Turkish Republic Ministry of Food, Agriculture and Animal Husbandry General Directorate of Plant Protection and Plant Quarantine Research Section, No: 13, 251-255.

12. ————————, 1979. Studies on the control possibilities of Chestnut Blight [**Endothia parasitica** (Murr.) A. and A.] in Turkey. I. Possible uses of some systemic fungicides against the pathogen. J. Turkish Phytopath. **8**(2-3):51-76.

ein Überblick, II. Fungizidresistenz phytopathogener Pilze. Phytopath. Z., **86**:144-185.

14. FRAHM, J., 1973. Verhalten und nebenwirkungen von Benomyl. Pflkrankh. **80**:431-446.

15. FUCHS, A. and W. VIETS-VERWEIJ, 1975. Permanent and transient resistance to triarimol and triforine in some phytopathogenic fungi. Med. Fac. andbouww. Rijksuniv. Gent., **40**: 699-706.

16. GEORGOPOULOS, S.G., 1976. The genetics and biochemistry of resistance to chemicals in plant pathogens. Symposium on Resistance of Plant Pathogens to Chemicals, 90-96. **"In"** Proceedings of the American Phytopathological Society, Vol:3.

17. ———————— and C. DOVAS, 1973. A serious outbreak of strains of **Cercospora beticola** resistant to benzimidazole fungicides in Northen Greece. Pl. Dis. Reptr. **57**:321-324.

18. KARACA, İ., 1968. Sistemik Bitki Hastalıkları (Ascomycetes). Cilt III, Ege Üniversitesi Ziraat Fakültesi Yayınları No:143. VI + 242.

19. LITTRELL, R.H., 1974. Tolerance in **Cercospora arachicola** to benomyl and related fungicides. Phytopathology, **64**:1377-1378.

20. ————————, 1976. Techniques of monitoring for resistance in plant pathogens. Symposium on Resistance of Plant Pathogens to Chemicals, 90-96. **"In"** Proceedings of the American Phytopathological Society, Vol.3.

21. MEYER, J.A., A. POURTORIS, K. LUMANDE, and H. MARAITE, 1977. Tolerance to benomyl of **Botrytis cinerea** and **Fusarium oxysporum.** Neth. J.Pl. Path. **83**(Suppl.1):215-227.

22. OGAWA, J.M., B.T. MANJI and G.A. CHASTAGNER, 1976. Field problems due to chemical tolerance of plant pathogens. Symposium on

Resistance of Plant Pathogens to Chemicals, 47-53. "In" Proceedings of the American Phytopathological Society, Vol.: 3.

23. POLACH, F.J. and W.T. MOLIN, 1975. Benzimidazole-resistant mutant derived from a single ascospore culture of **Botryotinia fuckelliana.** Phytopathology, **64:** 1377-1378.
24. SEILER, J.P., 1975. The molecular mechanism of benzimidazole mutagenicity: **In vitro** studies on transcription and translocation. Biochemical Genetics, **13**(9-10).
25. ————————, 1976. The mutagenicity of benzimidazole and benzimidazole derivatives. V. Gas chromatographic-mass spectrometric analysis of benzimidazole nukleoside in **Escherichia coli** ribonucleic acid. Analytical Biochemistry, **75**:45-52.
26. ————————, 1978. The mutagenic mode of action of benzimidazole. Experienta, **34**:851-852.
27. SISLER, H.D., 1971. Mode of action of benzimidazole fungigcides. Proc. 2nd. Int. Congress of Presticide Chemistry, 324-335. "In" Presticide Chem Vol.: V, Garden and Breach, New York.
28. VAN TUYL, J.M., 1975. Genetic aspects of acquired resistance to benomyl and thiabendazole in a number of fungi. Med. Fac. Landbouww. Risjksuniv. Gent. **40**:691-697.
29. VAN TUYL, J.M., 1977. Genetics of fungal resistance to systemic fungicides. Meded. Landbouwhogeschool Wageningen, 77-2, 136 pp.
30. ————————, L.C. DAVIDSE and J. DEKKER, 1974. Lack of cross resistance to benomyl and thiabendazole in some strains of **Aspergillus nidulans**. Neth. J. Pl. Path. **80**:165-168.
31. VARGAS Jr., J.M., 1972. A benzimidazole resistant strains of **Erysiphe graminis.** Phytopathology, **62**:795.
32. ————————, 1973. A benzimidazole resistant strains of **Erysiphe graminis.** Phytopathology, **63**:1366-1368.

J. Turkish Phytopath. Vol. 9, Num.: 1, 49—55, 1980

A New Root and Foot-Rot Disease of Melons (Phytophthora drechsleri Tucker) in Central Anatolia and its Pathogenicity on Common Melon Cultivars in this Region

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ABSTRACT

Recently, an intensive foot and root-rot of melons has been observed at Kızılırmak, Çankırı, at the places where widespread melon cultivation is made. By this work, **Phytophthora drechsleri** Tucker was found to cause the disease. Five melon cultivars grown extensively in Central Anatolia, were tested against this disease and found very susceptible.

INTRODUCTION

Phytophthora species have been gaining importance in recent years in Central Anatolia. So far, **P.capsici** Leon. on peppers (Karahan and Maden 1974) and **P. parasitica** Dast. on tomatoes (İren et al. 1978) have been reported in this region. Besides, İren and Maden (1976) mentioned that **P. capsici** caused disease on squash, water-melon and cucumbers in addition to peppers. However, **Phytophthora** spp. have not been reported on melons in Turkey so far.

In foreign literature, **P. capsici, P. drechsleri** and **P. nicotiana** var. **parasitica** have been recorded on melons. Clerjeau (1973), in France, reported that melons grown in contaminated fields with **P. capsici** and **P. nicotiana** var. **parasitica** showed disease by these causal agents. Ershad (1971), in Iran found out that **P.**

drechsleri caused intensive root-rot and wilting on melons in irrigated areas. He also stated that **P. drechsleri** killed cucumber, water-melon, sugar-beet, sunflower, chich-pea and safflower in addition to melon. In the U.S.A., it was reported to be very harmful to safflower (Duniway 1975 a and b).

In some of the melon fields in Kızılırmak, Çankırı, intensive root - rot of melons has been observed. Specially under irrigated conditions, damage reached nearly to 100 percent. By taking into consideration of the importance and possibility of spread of the disease, this work was carried out.

MATERIALS AND METHODS

Development of the disease was investigated by showing clean seeds to the infested soil, brought from contaminated field. Symptoms of dead seedlings were examined and the fungal agent was isolated in P.C.N.B.-Grated Carrot Agar (75 g. thin grated carrot, 10 g agar, 1000 ml distilled water and 100 mg Pentachloronitrobenzene a.i) (PCNB- GCA). For this purpose, diseased seedlings were washed- off throughly, a small piece from newly killed hypocothyl were cut and dried between blotter papers and plated in this medium.

Colony characteristics and mycelial growth of the fungus were described by culturing the fungus in Carrot Extract Agar (CEA) (200 g thin grated carrot were boiled an hour in 500 ml distilled water, passed through muslin, completed to 1000 ml g agar was added and sterilized).

For sporangia and zoospore development a small piece of young culture about 1 sq cm in CEA was taken and immersed in Petri's Mineral Solution (0,4 g $Ca(NO_3)_2$, 0.15 g $MgSO_4$ 7 H_2O, 0.15 g KH_2PO_4, 0.06 g KCl and 1000 ml distilled water). and then kept under day-light or without light in the laboratory.

In order to find out the pathogenicity of the fungus and reactions of 5 melon cultivars to it, clean sound seeds of Mihallıçcık, Kırkağaç, Kuşçular, Sarıdilim and Yuva melon cultivars were selected, disinfected in 1 % Na OCl for 5 min. and sown in pastorized pots (18 cm diameter) 15 seeds each.

At 2-4 leaf stage in every pot 10 seedlings were left and this was done with three replicates. At this stage, artificial inoculum was given. The inoculum was prepared as following:

Seven full-grown cultures of the fungus in petri plates (9 cm diameter) in GCA medium were blended with a blender and all the culture mixed with 3 lt of water. 200 ml from this suspension was given to every pot. Only top water were given to uninoculated ones. One day after inoculation all the pots were watered once more and then they were watered when they required. Percentages of dead plants were calculated 5,12 and 40 days after inoculation.

RESULTS AND DISCUSSION

Melon seeds which were sown in the infested soil with **P. drechsleri** germinated without showing disease sympthoms. But ater emergence in some of the seedlings, the disease started with collar rot and plants were dropped off, wilted and killed from this place (Fig.1 b and d). These sympthoms were identical with the ones mentioned in the literature (Ershad 1971). The disease disseminated quickly and in 20 days nearly all the plants in the plots were killed.

P. drechsleri showed a rapid growth in CEA medium. Central parts of the colony was thick and fluffy because of aerial mycelium, while the margin was depressed and thin (Fig. 2 a). The appearence in general was lobed and radiated but not very prominent. Mycelium was consisted of non septate and thick hyphae and branching with right angles very often (Fig. 2 b). All these aspects of the fungus except colony appearence were in agreement with Ershad (1971)'s findings. But he reported that isolates of **P. drechsleri** from **Cucurbitaceae** had an even growth in CEA medium. In this work colonies of the fungus showed slightly lobed growth which could be affected by small differences in the medium prepared in the laboratory.

P. drechsleri did not produced sporangia in solid media (GCA,CEA) but rarely in the places of the culture where bacterial contamination occured, a few sporangia were observed. This situation was noted by Ershad (1971) too. When a piece of mycelial growth from CEA medium was taken and floated in Petris mineral solution under day light tubes, for 4-5 hours a lot of sporangium were produced. When that piece was kept in the solution for 18-24 hours no apparent sporangia were seen. It has been concluded that in the longer incubation period sporangia were produced but broken after zoospore discharge and never produced again. In the

same conditions, no sporangia were seen under laboratory conditions, without artificial light. For sporangial production light was necessary and this was mentioned in the literature too (Ershad 1971).

Sporangia were obpyriform to long pyriform, sometimes elliptic, egg form. Some of them had thin cressent shaped papillae (Fig. 2 c), some were without papillae (Fig. 2 d). Average sizes of the sporangia were 50.8 x 30.8 micron, maximum and minimum 35.8 - 66.6 x 15.6 - 39.2 micron, length/width ratio is 1.64/1. Ershad (1971) stated that average sizes of sprongia of different isolates from different hosts varied very much but measures of this isolate remained in the ranges of various isolates. The form of the sporangia were identical with the ones described in the literature.

Differentiation of zoospores generally took place out of the broken sporangia and soon after they germinated (Fig. 2 e).

Hyphal swellings were also observed in the old cultures (Fig. 2 f).

Susceptibility of some melon cultivars to **P. drechsleri** is illustrated in table 1.

Table 1. Percentage mortality of 5 melon cultivars after 5,12 and 40 days from inoculation with **Phytophthora drechsleri**

Melon cultivars	5.day	12.day	40.day
Kırkağaç	60	66	96
Kuşçular	73	96	100
Mihallıççık	56	70	100
Sarıdilim	46	76	96
Yuva	60	66	90
Control	0	0	0

As it can be seen in the table 1, all melon cultivars tested were very susceptible to **P. drechsleri.** The pathogen killed more than 50 percent of the plants 5 days after inoculation (Fig. 1 b). The percentage mortality increased in correlation with time and it reached nearly 100 percent on 40. day. There was not any difference in susceptibility between the melon

cultivars. The difference observed in the field may be due to uneven distribution of the inoculum in the soil and varying soil characteristics.

It has been reported that **P. drechsleri** kills melon at all the growing stages and besides melon it is harmful to sunflower, safflower, cucumber (Duniway 1975 a and b, Ershad 1971). For this reason this pathogen can cause economically important damage in our country too.

ÖZET

ORTA ANADOLU BÖLGESİNDE KAVUNLARDA YENİ BİR KÖK VE KÖK BOĞAZI ÇÜRÜKLÜĞÜ HASTALIĞI (**Phytophthora drechsleri** Tucker)'NIN TANIMI VE BAZI KAVUN ÇEŞİTLERİNİN BU ETMENE KARŞI REAKSİYONLARI

Çankırı ili Kızılırmak bucağında yaygın olarak kavun yetiştiriciliği yapılan bazı yerlerde kavunlarda şiddetli kök ve kök boğazı çürüklüğü görülmüştür. Bu kök çürüklüğü sonucu bitkilerde ani solgunluk olmuştur. Bu hastalığa **Phytophthora drechsleri** Tucker'in neden olduğu saptanmıştır. Orta Anadolu Bölgesinde yaygın olarak ekilen 5 kavun çeşidi bu hastalık etmenine karşı çok duyarlı bulunmuştur.

LITERATURE CITED

CLERJEAU, M., 1973. Une nouvelle maladie du collet du melon due a **Phytophthora nicotiana** Br. de H. var. **parasitica** (Dastur) Waterh. et **Phythophthora capsici** Leon. Academie D Agriculture De France, Extrait du proces verbal de la Seance du 10 Janvier 1973, pp. 54-58.

DUNIWAY, J.M., 1975 a Water relations in sanflower during wilting induced by **Phytophthora** root-rot. Phytopathology, 65; 886-891.

————, J.M., 1975 b. Limiting influence of low water potential on the formation of sporangia by **Phytophthora drechsleri** in soil. Phytopathology, 65: 1084-1093.

ERSHAD, D.., 1971. Beitrag zur Kenntnis der **Phytophthora**-Arten in Iran und ihrer phytopathologischen Bedeutung. Mitteilungen aus der Biologischen Bundesanstalt für Land-und fortwirtschaf, Berlin-Dahlem. Heft 140.

İREN, S. ve S. MADEN, 1976. Bazı patlıcangil ve kabakgil türlerinin biberlerde yanıklık hastalığı etmeni **Phytophthora capsici** Leon. enfeksiyonlarına karşı serada reaksiyonlarının tesbiti. Ank. Üniv. Ziraat Fak. Yıllığı, 26(2); 323-330.

————., ————., S. KOCABIYIK, 1978. Domateslerde **Phytophthora parasitica** Dast.'nın saptanması, **P. capsici** Leon. ile karşılaştırmalı kültürel ve morfolojik özellikleri, domates ve biberlerdeki patojeniteleri üzerinde araştırmalar. II. Türkiye Fitopatoloji Kongresinde sunulan tebliğ. 9-13 Ekim 1978, Ankara.

KARAHAN, O. ve S. MADEN, 1974. Orta Anadolu Bölgesinde biberlerde kök boğazı yanıklığı (**Phytophthora capsici** Leon.) hastalığının tanımlanması ve zararı. Bitki Koruma Bülteni, 14(3):147-150.

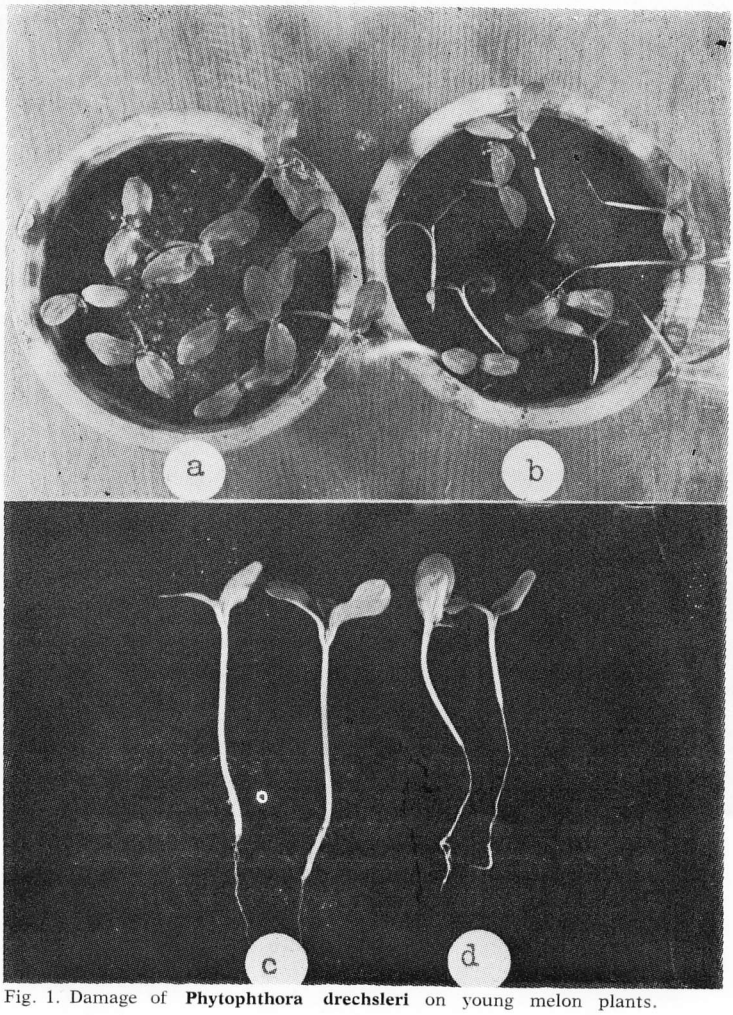

Fig. 1. Damage of **Phytophthora drechsleri** on young melon plants. a and c) Healthy b and d) diseased seedlings.

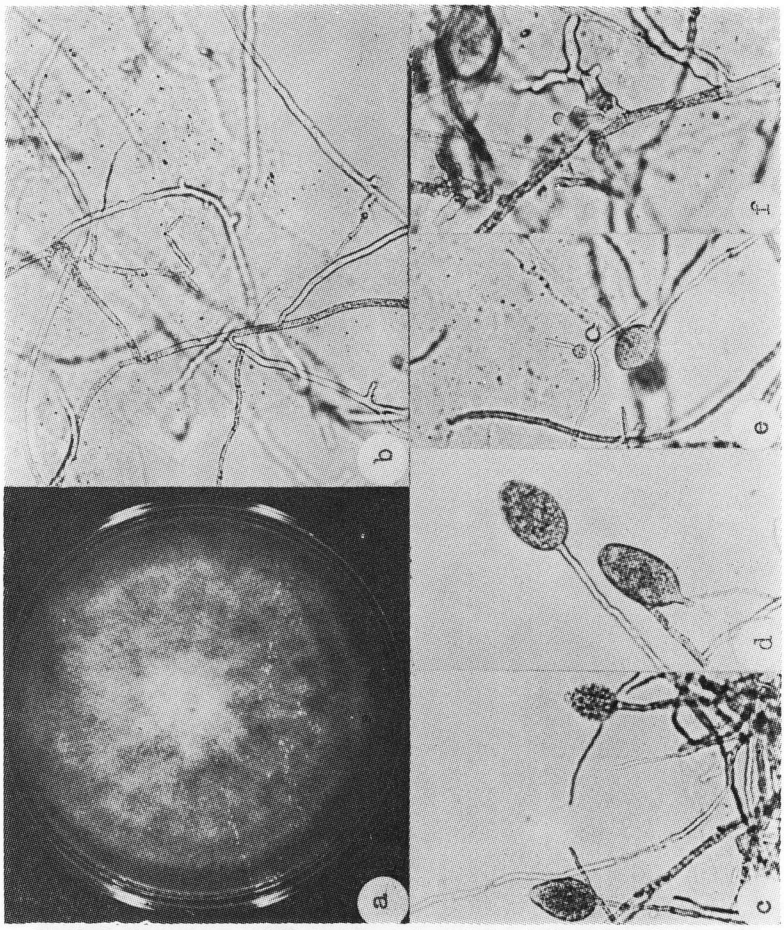

Fig. 2. Various aspects of **Phytophthora drechsleri.** a) Growth in CEA b) hyphae (x190) c and d) sporangia (x190 andx300) e) germinated zoospores (x190) f) hyphal swellings (x800)

All Correspondance Should Be Made To
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