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Eine Untersuchung über die Vermischung der Samen des Ackersenfes (Sinapis arvensis L.) bei Sommergerste in Korn und Stroh bei unterschiedlicher Ernteart

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ZUSAMMENFASSUNG

Bei den auf den Versuchsaeckern des Versuchsgutes der landwirtschaftlichen Fakultaet (Atatürk Üniversitesi - Erzurum) und den Versuchsfeldern des Institutes für Pflanzenschutz der Universitaet Hohenheim (BRD) durchgeführten Versuchen wurde durch vermehrtes Wachstum von Ackersenf pro m^2 in Sommergerste der prozentuale Anteil der Vermischung bei Erntegut und Stroh bei Dreschmaschinen - und Maehdrescherernte untersucht.

1— Es konnte kein Unterschied zwischen vermehrter Pflanzenzahl von Ackersenf und der Vermischung der Samen im Erntegut von Sommergerste gefunden werden.

2— Die Vermischung von Samen von Ackersenf im Erntegut von Sommergerste war bei einer Ernte mit der Dreschmaschine um 59-60 % höher als bei der Ernteeinbringung mit dem Maehdrescher.

3— Die Gesamtmenge der vermischten Samen mit dem Stroh betrug bei Dreschmaschineneinbringung 18,1 - 28,5 %.

4— Die Miteinbringung der Unkrautsamen bei Dreschmaschinenerntung betrug im Erntegut und Stroh 27,9 - 43,5 %, bei Maehdreschererntung zwischen 14,1 - 16,8 %.

EINLEITUNG

Neben vielen Schaeden durch das Unkraut spielt es auch eine grosse Rolle bei der Qualitaetsminderung durch Vermischung im Erntegut. Die Vermischungsmöglichkeiten der Unkrautsamen mit dem Erntegut sind abhaengig von den Arteigenschaften und der Ernteeinbringungsart (Kuntay, 1944; Seibold, 1953; Eggebrecht, 1953; Göksel, 1956; Dadd, 1956; Koch-Hurle, 1978). Göksel (1959) schaetzt die Vermischungsmöglichkeiten der Unkrautsamen mit dem Erntegut in der Türkei auf 20 - 25 %.

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Die durch die Art der Ernteeinbringung bedingte Unkrautsamenverstreuung auf dem Feld ist ein Faktor, der die Bekaempfung erschwert und die Verbreitung foerdert. Besonders nach Benutzung des Maehdreschers wurde eine Populationserhöhung des Unkrautes bei vielen Untersuchungen festgestellt (Buchwaldt, 1956; Dellinger, 1953; Holldack, 1949; Petzoldt, 1957; Seibold, 1953). Auch in der Türkei wurde eine Vermehrung des Unkrautes auf mit der Dreschmaschine gedroschenen Ernteflaechen beobachtet. In dieser Arbeit wurde die Vermischung der Ackersenfsamen abhaengig von Ernteart im Sommergerstkorn und Stroh untersucht.

MATERIAL UND METHODEN

Als Material wurde Sommergerste und Ackersenf benutzt. Die in Sommergerste vorkommenden Ackersenfpflanzen wurden im Rosettenstadium in je 4 Parzellen von $2 \times 5 = 10\ m^2$ Grösse pro m^2 zu 10, 20, 30 und 40 Pflanzen ausgezaehlt. Die Untersuchungen wurden in den Jahren 1977 und 1982 am Versuchsgut der Atatürk Universitaet - Erzurum und im Jahre 1978 auf dem Versuchsfeld des Institutes für Pflanzenschutz der Universitaet Hohenheim durchgeführt. Bei den Versuchsparzellen in Erzurum ging die Ernteeinbringung mittels Dreschmaschine von statten, bei den Hohenheimer Parzellen mittels Maehdrescher. In jeder Parzelle wurde die Zahl der Ackersenfsamen, die mit den Gerstesamen vermischt waren, ausgezaehlt. Ausserdem wurde bei der Dreschmaschinenerntung die Vermischung der Zahl der Ackersenfsamen mit den Halmen bestimmt. Bei jeder Parzelle wurde für die Unkrautsamenvermischung bei Korn und Halm die Varianzanalysenbestimmung durchgeführt (Düzgüneş, 1963). Die herausgefundenen Mittelwerte wurden nach dem Duncan Mehrheitsvergleichtest auf ihre negativen Seiten untersucht (Snedecor, 1956).

ERGEBNISSE

Die Vermischung von Ackersenfsamen im Erntegut bei verschiedener Pflanzenzahl bei Dreschmaschineneinbringung und Ernte mit Maehdrescher:

Bei einer Ernte mit Dreschmaschine und Maehdrescher konnte trotz unterschiedlicher Menge von Ackersenfsamen pro m^2 kein statistischer Unterschied bei der Samenvermischung im Korn festgestellt werden.

Obwohl kein wesentlicher statistischer Unterschied bei den von verschiedener Pflanzenzahl ausgebildeten Samen festgestellt werden konnte, war die Zahl zahlenmaessig hoch (Tab. 1, 2, 3).

Die verschiedene Vermischungsmöglichkeit abhaengig von Ernteart der Samen von Ackersenf und Gerstekorn:

Der Vermischungsunterschied von Ackersenfsamen mit Gerstekorn bei Dreschmaschinenerntung und Maehdreschererntung wurde statistisch signifikant gefunden (Tab. 4, 5).

Die Möglichkeit der Verschleppung der Samen mit dem Stroh auf dem Dreschplatz bei Dreschmaschinenernte:

Durch die verschiedene Ackerpflanzenzahl pro m² konnte bei Dreschmaschin nernte bei der Vermischung von Stroh mit Samen keine bedeutende statistische Signifikanz gefunden werden. Trotz unbedeutender statistischer Signifikanz war die Vermischung Zahlenmaessig bedeutsam (Tabelle 6, 7).

DISKUSSION DER ERGEBNISSE

A — Die Möglichkeit der Vermischung von Ackersenfsamen bei Gersteerntung mit Dreschmaschine und Maehdrescher im Zusammenhang von unterschiedlicher Pflanzenzahl.

Zwischen der Pflanzenzahl pro m² und der Vermischung ihrer Samen im Erntegut wurde keine statistische Signifikanz gefunden. Waehrend die Zahl der Ackersenfsamen bei Erntung mit Dreschmaschine pro Parzelle im Erntegut im Jahr 1977 bei 3909 - 4287 lag, lag sie im Jahr 1982 bei 3890 - 4208 (Mittelwert) (Tab. 1, 2). Dagegen betrug die Zahl der Ackersenfsamen im Erntegut 2167 - 2618. Bei Betrachtung von Tab. 8 sieht man, dass durch Konkurrenzwirkung sich die Samenzahl vermindert, wenn sich die Pflanzenzahl vermehrt (Roemer und Scheffer, 1959; Koch, 1969; Özer, 1984). Befinden sich 10 Ackersenfpflanzen pro m² in Sommergerste wurden pro Pflanze 262 Samen ausgebildet; bei 40 Pflanzen pro m² wurden pro Pflanze 103 Samen ausgebildet. Das heisst, wenn sich in der Parzelle pro m² 10 Pflanzen befinden 2620 Samen ausgebildet werden, bei 40 Pflanzen werden 4120 Samen ausgebildet, aus diesem Grund wurde keine statistische Signifikanz festgestellt. Vermutlich ist die Zahl der ausfallenden Samen vor und waehrend der Ernte bei vermehrter Pflanzenzahl auf bestimmter Flaeche höher, aus diesem Grunde konnte kein besonderer Unterschied zwischen der Vermehrung der Ackersenfpflanzen und der Vermischung der Samen im Erntegut festgestellt werden.

B — Die Vermischungsmöglichkeit von Ackersenfsamen in Sommergerste bei unterschiedlicher Ernteart.

Bei Ernteeinbringung mit Dreschmaschine oder Maehdrescher wurde bei der Samenvermischung eine statistische Signifikanz ge-

funden (Tab. 4). Bei Betrachtung von Tab. 5 sieht man, dass bei Dreschmaschineerntung im Jahr 1977 und 1982 pro m² 402,0 - 407,5 Ackersenfsamen vermischt waren, bei Maehdrescherernung 1987 waren es 241,3 Samen. Der Grund der geringeren Vermischung von Ackersenfsamen bei Maehdrescherernung ist die waehrend der Aussonderung von Korn und Stroh zustande gekommene Luftströmung, und da die Samen rund und glatt sind werden sie leicht verstruet (Petzoldt 1957).

Da bei Dreschung mit der Dreschmaschine die Aussonderung von Korn und Stroh auf dem Dreschplatz stattfindet, verringert sich die Möglichkeit, im Gegensatz zur Maehdreschereinbringung, dass die Samen auf dem Feld erneut verstreut werden.

Bei gleicher Pflanzenzahl konnte zwischen Erzurum und Hohenheim bei der Ausbildung der Samen kein statistischer Unterschied festgestellt werden.

Waehrend bei Ernte mit Dreschmaschine und Maehdrescher Unterschiede bei der Vermischung mit dem Erntegut festgestellt werden konnten, konnte auch eine Verschiedenheit abhängig von der Ernteart bei der Ausbildung der Samen der Pflanzen pro m² festgestellt werden. Zum Beispiel, wie man auf Tab. 8 sieht, bildeten 10, 20, 30 und 40 Ackersenfpflanzen pro m² im Mittelwert 2620, 3440, 3600 und 4120 Samen aus. Die Vermischungsmöglichkeit dieser Samen beträgt bei Mähdrescher 204 ∓ 11,9 Samen, bei Dreschmaschine 239 ∓ 11,3 Samen. Vergrössert sich die Pflanzenzahl pro m², so verringert sich die ausgebildete Samenzahl der einzelnen Pflanze. Vermutlich bildet die durch Konkurrenzwirkung geschwächte Pflanze schwache Samenkapseln aus, und dadurch ist vor und während der Ernte die Verstreuung der Samen grösser. Aus diesem Grunde konnte bei einer erhöhten Pflanzen - und Samenzahl auch eine größere Vermischung der Samen im Erntegut nicht bestätigt werden.

C — Möglichkeit der Verschleppung von Samen mit Stroh bei Mähdrescherernte.

Bei Mähdrescherernte wird durch die zustande gekommene Luftströmung ein grosser Teil der Samen auf dem Feld verstreut (Buchwald, 1956; Dadd, 1956; Dahlinger, 1953; Seibold, 1953). Bei Mähdrescherernung verblieb nach Ernte 5 % der Samen mit dem Stroh auf dem Feld (Petzoldt, 1957).

Trotz Vermehrung der Ackersenfpflanze und ihrer vermehrten Samenzahl pro m² konnte bei Mähdrescherernte kein wichtiger statistischer Unterschied bei der Samenmenge im Stroh festgestellt werden.

Dennoch war die Höhe der mit dem Stroh auf den Dreschplatz gebrachten Samen beträchtlich (Tab. 6, 7).

Der Ackersenf verstreut 50 - 55 % seiner Samen zur Erntezeit (Petzoldt, 1957; Koch, 1969). Wir müssen einen nicht geringen Teil der Samen berechnen, die während der Ernte von Sommergerste und Tragen des Getreides auf dem Dreschplatz, auf dem Feld verbleiben. Trotz unterschiedlicher Zahl der Ackersenfpflanze und unterschiedlicher Samenausbildung pro m² betrug die Vermischung im Stroh 735,2 - 13,6 (Mittelwert). Wenn man annimmt, dass 50 % der Samen vor der Ernte ausfallen, werden bei Ernte mit der Dreschmaschine, wenn man pro m² 10 - 40 Pflanzen berechnet, von den ausgebildeten Samen 9,8 % - 15,0 % im Korn, 18,1 % - 28,5 % im Stroh gefunden, und bei der Gesamtzahl der Samen wird verhindert, dass 27,9 % - 43,5 % auf dem Feld verstreut werden. Dagegen vermischt sich bei Mähdrescherernte 5,8 % - 9,1 % der Samen mit dem Korn. Nach Petzoldt (1957) beträgt die Menge der Samen im Stroh 5 %, aus diesem Grunde beträgt die Prozentzahl der Samen, die vom Feld entfernt werden, 10,8 % - 14,0 %.

Als Endergebnis sieht man, dass bei Dreschmaschinenernte ein Grossteil der Samen vom Feld entfernt wird; aus diesem Grunde konnte festgestellt werden, dass bei Dreschmaschinenernte entgegen Mähdrescherernte die Ackersenfpopulation auf dem Feld verringert wird.

ÖZET

YAZLIK ARPADAKİ YABANİ HARDAL (**Sinapis arvensis** L.) TOHUMLARININ HASAT ÇEŞİDİNE BAĞLI OLARAK DANE VE SAPA KARIŞMA OLASILIKLARI ÜZERİNDE BİR ARAŞTIRMA

Erzurum Atatürk Üniversitesi Ziraat Fakültesi İşletme Çiftliği ile Hohenheim Üniversitesi Bitki Koruma Enstitüsü Deneme Tarlalarında (F. Almanya) yapılan bu çalışma ile yazlık arpa içerisinde m² de yabani hardal bitki sayısının artması sonucu harman makinası ve biçer döverle yapılan hasatta tohumların arpa danesine ve samanına karışma olasılıkları araştırıldı.

1— Yazlık arpa içerisinde bulunan yabani hardal sayısının artışı ile tohumların arpa danesine karışma miktarları arasında bir farklılık saptanamamıştır.

2— Yabani hardal tohumlarının arpa danesine karışmaları harman makinası ile yapılan hasatta biçer döverle yapılan hasada oranla % 50-60 daha fazla olmaktadır.

3— Harman makinası ile yapılan hasatta yabani hardal tohumlarının samana karışma cranı toplam tohumun % 18.1 - 28.5 teşkil etmektedir.

4— Harman makinasıyla yapılan hasatta daneye ve sapa karışarak tarladan uzaklaştırılan yabani hardal tohumunun % 27,9 - 43,5; biçer döverde % 14.1 - 16.8 arasında olduğu saptanmıştır.

Tabelle 1 : Mittelwert der vermischten Samen bei Dreschmaschinenerntung im Jarh 1977.

Ackersenfzahl pro m²	Samenzahl pro Parzelle
10	3917
20	3909
30	4287
40	4187

Tabelle 2 : Mittelwert der vermischten Samen bei Dreschmaschinenerntung im Jahr 1982.

Ackersenfzahl pro m²	Samenzahl pro Parzelle
10	3932
20	4050
30	3890
40	4208

Tabelle 3 : Mittelwert der vermischten Samen im Erntegut pro Parzelle bei Maehdreschererntung im Jahr 1978.

Ackersenfzahl pro m²	Samenzahl pro Parzelle
10	2167
20	2618
30	2386
40	2481

Tabelle 4 : Tabelle über die Varianzanalyse bei verschiedener Ernteart und die dadurch eingetretene unterschiedliche Vermischung

Varianz Quelle	F.Z.	Mittelwert der Quatrate	F
Allgemein	8	—	
Vergl. zwischen Ernteart	2	34520	42.35xx
Fehler	6	815	

(xx) 1 % iger Wahrscheinlichkeit signifikant

Tabelle 5 : Die Vermischungsmenge Ackersenfsamen pro Parzelle bei Dreschmeschinen - und Machdreschrerntung

Ernteart und Jahr	Samenzahl Parzelle	Samenzahl pro m²
Dreschmaschine 1977	4075 a (1)	402,5
"	4020 a	402,0
Maehdrescher 1978	2413 b	241,3

(1) Die mit dem gleichen Buchstaben bezeichneten Mittelwerte gehören zur gleichen Gruppe.

Tabelle 6 : Mittelwerte der Vermischung von Ackersenfsamen pro Parzelle mit dem Stroh bei Dreschmaschinenerntung im Jahr 1977

Ackersenfzahl pro m²	Samenzahl pro Parzelle
10	6990
20	7308
30	7380
40	7340

Tabelle 7 : Mittelwert der Vermischung von Ackersenfsamen pro Parzelle mit dem Stroh bei Dreschmaschinenerntung im Jahr 1982

Ackersenfzahl pro m²	Samenzahl pro Parzelle
10	6945
20	7367
30	7488
40	7304

Tabelle 8 : Die Mittelwerte der ausgebildeten Samen von Ackerfpflanzen in Sommergerste (Özer 1984).

Ackersenf	Samen pro Pflanzen				
Zahl / m²	1977	1978	1982	Mittelwert	Zahl / m²
10	240	251	295	262,0	2620
20	178	173	167	172,6	3452
30	120	124	116	120,0	3600
40	100	106	103	103,0	4120

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Some Aspects of the Host-Pathogen Interaction in Leaf Scald of Barley Caused by **Rhynchosporium secalis** (Oudem.) J.J. Davis

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ABSTRACT

On barley leaves the penetration of **Rhynchosporium secalis** (Oudem.) J.J. Davis usually occured through cuticula and the subcuticular hypae developed into stromata. Beneath the subcuticular development epidermal cells affected and the tissues of epidermis and mesophyll begun to be invaded. This appeared as water-soaked greyish-blue lesions on leaves similar to those produced on seedlings immersed into culture filtrates. The break down of the invaded tissues were resulted in necrotic white grey lesions with dark brown margins Vascular tissues might also be invaded.

Conidia developed on the short segments of subcuticular hyphae and on stromatic cells by budding.

Stromata formed on infected sheaths. The superficial hyphae protruding from the inside of the sheaths of the upper leaf could be responsible to the infection of the emerging leaf.

INTRODUCTION

Barley scald (**Rhynchosporium secalis** (Oudem.) J.J. Davis) is an important disease in barley (**Hordeum vulgare** L.) growing areas, capable of causing considerable reduction in yield and quality of the grain. The use of resistant cultivars is an economic and effective means of control (Starling et al. 1971, Marshall 1973, Habgood 1974). So attention has always been focused on the need to obtain resistant cultivars. In order to facilitate the development of such cultivars, it is necessary to understand the nature of resistance mechanism operating in the plants. The first comprehensive study on this subject was by Caldwell (1937). Later, Ayesu-Offei and Clare (1970) and Hosemans and Branchard (1985) reported the various aspects of this host-pathogen combination. The involvement of fungal toxic metabolites were also investigated. However, the results of Ayesu-Offei and Clare (1971) and Jones and Ayres (1972) on this matter were contradictory.

The studies reported here were undertaken in order to provide more information about the host-pathogen interaction and to re-examine the effect of culture filtrates of **R. secalis** on a different barley cultivar.

MATERIALS and METHODS

A susceptible barley cultivar Tokak and an **R. secalis** isolate obtained from this cultivar were used in these experiments. Barley plants were grown in 10 cm plastic pots containing disinfected soil in a growth cabinet operating daily for 16 h at 20-22°C and 5 klx light intensity and 8 h at 14-16°C in the dark. The plants at the fourth leaf stage were uniformly sprayed until run-off with conidial suspension adjusted to 10^6canidia/ml and containing two drops of surfactant (Tween 20) per 100 ml. Spore suspension was prepared from two weeks old cultures grown on lima bean agar at 15°C. The inoculated plants were enclosed in clear polyethylene bags for 24 h at 15°C in dark to facilitate the infection process. Then the plants were returned to the conditions in which they had been grown. After inoculation, on the first day every four h and then at daily intervals, the third leaves of four plants were excised.

To induce sporulation the plants having lesions were kept for 24 h in a saturated atmosphere at the same conditions of the growth cabinet. During this period four leaves and sheaths were removed every two h.

After each sampling half of the specimens were cut into about 0.5 cm^2 pieces, decolorised in a mixture of lactophenol + methanol + chloroform (5:3:2) and stained with cotton blue in lactophenol and mounted in clear lactophenol (Döken 1981). The other half of the specimens were placed into seperate vials containing formalin-acetic-alcohol for fixing and preserving. Later the fixed material was washed in water, dehydrated in a graded ethanol series, embeded in wax and serial sections 10 um thick were cut. Then the sections were affixed to slides and wax was removed. They were stained with periodic acid-Schiff reagent (Preece 1959) and counter stained for 5 min. in 1 % methylene blue in 95 % ethyl alcohol and mounted in Entellan. All the slides were examined by light microscopy.

In the preparation of culture filtrates two weeks old **R. secalis** cultures grown on 1 % malt yeast medium at 15°C were used (Ayesu-Offei and Clare 1971). Uninoculated medium was taken as control. These cultures were strained through muslin and centrifuged at about 4000 g for one h to remove the fungal structures. Then the supernatant

was filtered through a bacterial filter. The same procedure was applied to uninoculated medium. Tokak barley cultivar seedlings at the third leaf stage were cut just above the soil level and immersed in culture filtrates or control solutions. Symptom development was then observed.

RESULTS and DISCUSSION

On the inoculated leaves conidial germination began within 4-8 h by producing germ tubes some of which had terminal appressorium (Fig. 1). Most conidia produced two germ tubes and the first often emerged from the apical cell. A maximum of five germ tubes was recorded from a single conidium (Fig. 2) while Ayesu-Offei and Clare (1970) found three germ tubes.

The penetration usually took place directly through the cuticule both with the aid of an appressorium as well as without it (Fig. 3) as evidenced by Ayesu-Offei and Clare (1970), Ryan and Clare (1974), Hosemans and Branchard (1985). In very rare cases stomatal entry was also seen (Fig. 4), although it was not detected by Ayesu-Offei and Clare (1970). According to Jones and Ayres (1974) in few cases the superficial hyphae may grow into stomatal pore. Probably the tips of the germ tubes which cross stomatal pores may enter. However it was not feasible to observe whether stomatal entry led directly to infection. But the absence of mycelium in mesophyll just before and during the establishment of subcuticular hyphae implied that stomatal entry has no importance in the initation of infection. In rare cases even if it resutls in infection, stomatal penetration may have an effect only in the infection of the cultivars where direct cuticular penetration is not succesfull. Unless in barley cultivars cuticular thickness has no resisting effect on direct penetration (Ayres and Owen 1971).

Following penetration, the infection hyphae which became subcuticular, branched and grewn along the junctions between the epidermal cells (Fig. 5). This subcuticular growth manner was attributed to the presence of rich pectic substances in these regions (Jones and Ayres 1974). During the subcuticular development the hyphae were also organised to form stromata usually elongating parallel to veins (Fig. 6). In this stage the epidermal layer was affected and the tissues below the cuticule begun to be invaded. This appeared as water-soaked greyish-blue areas on leaves similar to those produced on seedlings immersed into culture filtrates. These lesions began to develop in 2-3 h after immersion. In a similar study Ayesu-Offei and Clare (1971) suggested that toxic metabolites of **R. secalis** are responsible for such symptoms. This was not confirmed by Jones and Ayres (1972) who indicated that

it was due to the blockage of xylem elements in the leaf by the culture medium. However lack of such symptoms on seedlings placed in filtrates of uninoculated medium indicated the presence of such toxic fungal metabolites in culture filtrates. A toxin was detected in **R. secalis** cultures (Rafenomananzara et al. 1979) who later (Rafenomananzara et al. 1983) found that phytotoxins produced by **R. secalis** are α-0-1 glucosides of propanediol.

Subcuticular hyphae initiated the invasion of the leaf tissues by advancing into underlying cells. According to Caldwell (1937) following the collapse of the epidermis, the hyphae from stroma penetrate directly through epidermis into mesophyll. But in the studies of Ayesu-Offei and Clare (1970) and Hosemans and Branchard (1985) subcuticular hyphae penetrate the epidermal layer particularly at the junotion of guard and epidermal cells. The hyphae entered into the mesophyll through intercellular spaces (Fig. 7). It was followed by intracellular development. The invaded epidermal and mesophyll cells were completely broken down (Fig. 8). This was resulted in typical necrotic white-grey lesions with dark brown margins.

Following the collapse of mesophyll cells the vascular tissues might also be invaded (Fig. 9) in which case the vascular flow may be reduced or inhibited at that point. When such an invasion was extended across the leaf blade then the leaf part above the invaded region was wilted and dried.

The hyphae which reached to the uninoculated side of the leaves through mesophyll, entered into stomatal cavities and then protruded out through stomatal pores (Fig. 10). Formation of substomatal stroma and then spore extrusion through the stomatal pore on uninoculated side of the leaves (Ayesu-Offei and Clare 1970) were not determined in the present study.

Under humid conditions sessile conidia began to be borne in about 4 h. They developed successively both on the short segments of subcuticular hyphae and on stromatic cells by budding (Fig. 11). After masses of mature conidia were produced, they forced their way out by repturing the cuticule as described by Ayesu-Offei and Clare (1970) and Hosemans and Branchard (1985).

The leaf sheaths were also infected and typical necrotic symptoms appeared in about three weeks as in leaves. Subcuticular stromatic development were observed on both sides of the sheaths. On the inner surface, the hyphae produced from the stromatic cells protruded out through cuticula (Fig. 12). This superficial hyphae especially inside the sheath of the upper leaf could be considerably important in initiating infection on the new leaf emerging through the sheath.

ÖZET

Rhynchosporium secalis (Oudem.) J.J. Davis'in OLUŞTURDUĞU ARPA YAPRAK LEKESİ HASTALIĞINDA KONUKÇU-PATOJEN İLİŞKİLERİNİN BAZI YÖNLERİ

Tokak arpa çeşidi yapraklarına inokule edilen **Rhynchosporium secalis** (Oudem.) J.J. Davis genellikle doğrudan kutikuladan veya çok ender olarak stomadan penetrasyon yapmaktadır. Kutikula altı gelişen hif'lerden stroma'lar oluşmaktadır. Bu gelişmenin altında bulunan epidermal tabakanın dejenarasyonu ve hif'lerin epidermis ve mezofil dokularına yayılmaya başlaması yapraklarda ıslak gri-mavimsi lezyonlar halinde belirmektedir. Benzer simptomlar kültür filtratlarına daldırılan fidelerde de oluşmuştur. Tipik koyu kahverengi sınırla çevrili oval beyaz-gri nekrotik lezyonlar ise epidermis ve mezofil dokularının parçalanması ile ortaya çıkmaktadır. Yaprakta hif'ler vasküler dokularda da gelişme göstermekte ve ayrıca yaprağın inokule edilmeyen yüzüne ulaşıp stomalardan dışarı çıkmaktadır.

Nemli koşullarda konidi'ler kutikula altı hif'lerin kısa dallarından ve stromatik hücrelerden tomurcuklanma şeklinde gelişmektedir.

Fungus yaprak kınlarını da enfekte ederek her iki yüzeyinde kutikula altı stroma'lar oluşturmaktadır. Ayrıca özellikle en üst yaprak kınının iç yüzeyinden kutikulayı delerek dışarı doğru gelişen hif'ler yeni çıkmakta olan yaprağa temas ederek onun da enfeksiyonuna neden olurlar.

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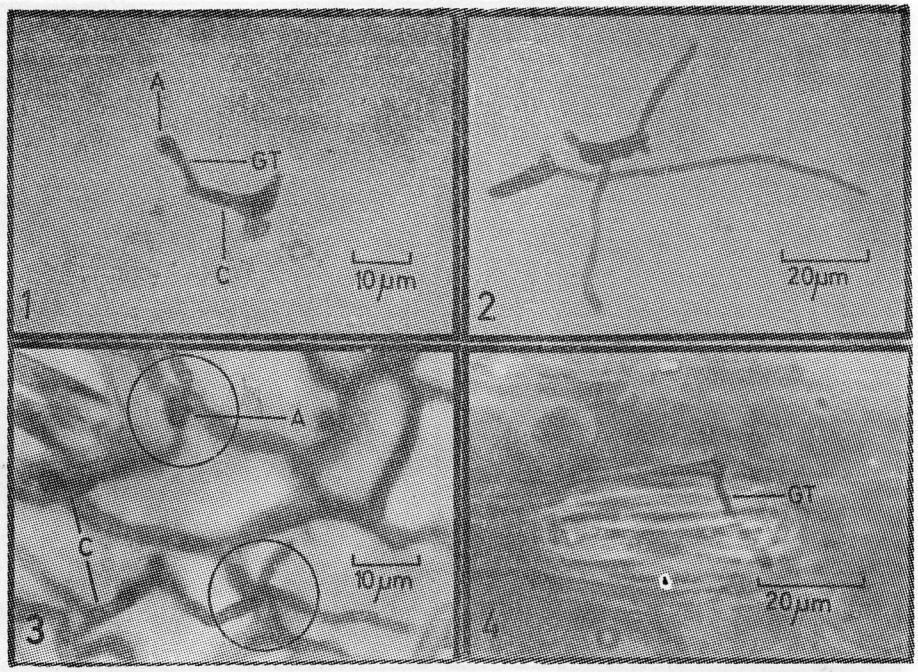

Fig. 1. Conidium (C) with germ tube (GT) and appressorium (A)

Fig. 2. Germination of conidia. Note the development of five germ tubes from one conidium

Fig. 3. Germinated conidia (C) giving rise to direct penetration (in circles) with and without appressorium (A) formation

Fig. 4. Germ tube (GT) entering into stoma

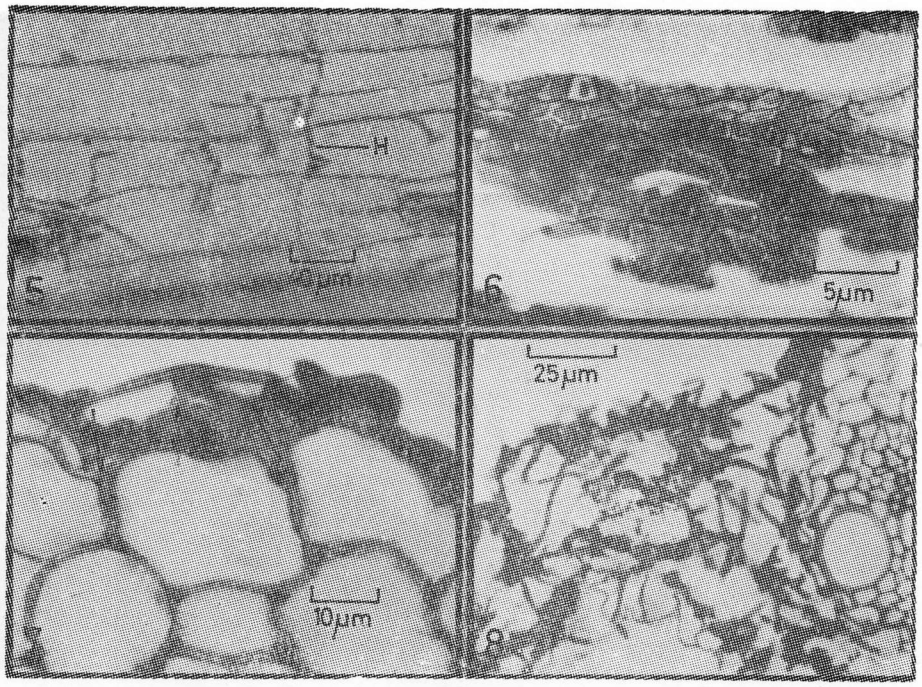

Fig. 5. Subcuticular hyphae (H) advancing especially along the junctions between the epidermal cells.

Fig. 6. Subcuticular stroma

Fig. 7. Penetration of hyphae (arrow) into intercellular spaces of mesophyll from the collapsed epidermis

Fig. 8. Transverse section of a portion of a leaf showing the complete break-down of epidermis and mesophyll

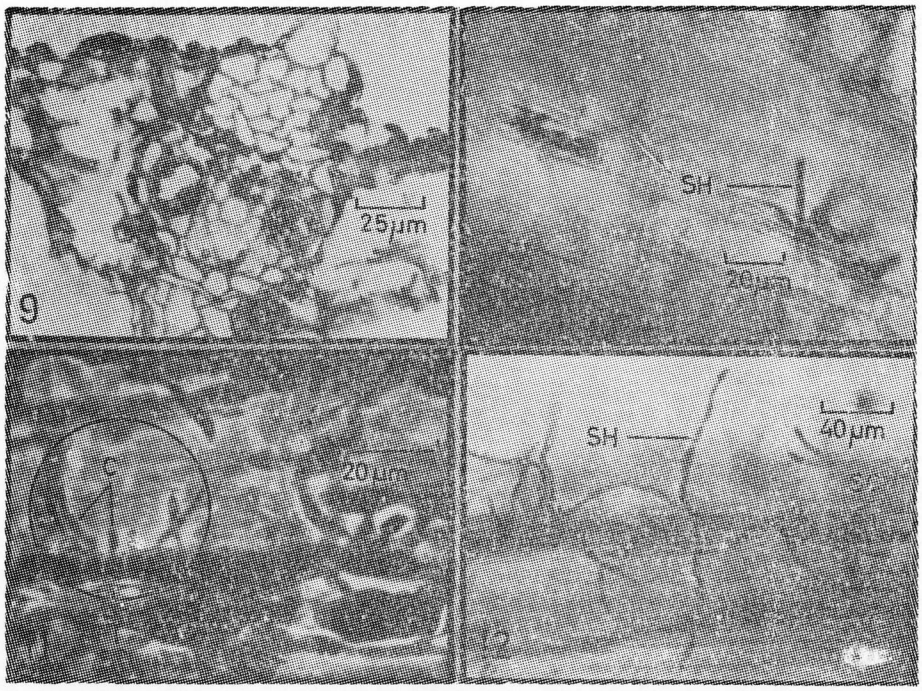

Fig. 9. Transverse section of a portion of a leaf showing the invaded vascular tissues

Fig. 10. Superficial hyphae (SH) emerging out through stomata on the uninoculated side of the leaf

Fig. 11. Conidial (C) formation (in circle) on stromatic cells (SC)

Fig. 12. Superficial hyphae (SH) which developed from stromatic cells (SC) being protruded out through cuticula inside the sheath

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Studies on the Fungicide Sensitivity of Vine Mildew (**Uncinula necator** (Schwein) Burr.) in Aegean Region of Turkey

Muallâ ARI* and Nafiz DELEN**

ABSTRACT

In the present study, total 32 isolates of **Uncinula necator** were obtained from vineyards of Aegean Region. The sensitivity levels of these isolates to triadimefon, fenarimol, bupirimate, benomyl and carbendazim were investigated.

According to MIC values, the sensitivity levels of 32 isolates were determined between 1.0 and 50.0 µg/ml for triadimefon, fenarimol and benomyl, 1.0 and 210.0 µg/ml for bupirimate and 1.0 and 450.0 µf/ml for carbendazim.

One carbendazim sensitivity-decreased isolate (MIC 450.0 µg/ml) was obtained from a vineyard which exposed continuous carbendazim applications in nature.

Pot studies revealed that a decreased sensitivity has been observed with the isolates (S-Car, MIC 400.0 µg/ml; S-Ben, MIC 600.0 µg/ml) as the result of continuous applications of benzimidazole group fungicides. It was found that their sensitivity against E.B.I's and hydroxypyrimidin group showed a decreasing tendecy. A cross-resistance was also found between the two benzimidazole group fungicides used in this experiment. On the other hand, a positive relationship was found between the decreased sensitivity to benzimidazoles and the fitness of the isolates.

The isolates with decreased sensitivity against carbendazim (S-Car, MIC 400.0 µg/ml) could not be controlled by the practical doses of the same fungicide as a result of pot studies.

INTRODUCTION

There are 840.000 hectars of vineyards in Turkey and 138.597 hectars of this amount established in Aegean Region from which 978.468 tons of production has been yielded recently (Anonymus, 1986). Among

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the different problems of viticulture, powdery mildew (**Uncinula necator** «Schwein» Burr) causes quantitative and qualitative crop losses every year.

Generally, the growers have used sulphur against this important disease in Aegean Region. Recently it has been noticed that one-site inhibitors like benzimidazoles (benomyl and carbendazim) hydroxypyrimidine compound bupirimate and ergosterol biosynthesis inhibitors (=EBI) (fenarimol and triadimefon) has been started to use. Mostly, these fungicides are applied by the growers without a strategy and out of the recommendations. Therefore, this present study was carried out in the years of 1982-1986 to find out the sensitivity of **U. necator** isolates to some of the one-site inhibitor fungicides, used in the vine yards of Aegean Region.

MATERIALS AND METHODS

Materials:

The chemicals used in the tests were: Triadimefon (Bayer A.G., Bayleton 5 % WP), fenarimol (Elanco, Rubigan, 12 % EC), bupirimate (ICI, Nimrod, 25 % EC), benomyl (E.I Dupont, Benlate, 50 % WP) and carbendazim (Hoechst E.G., Derosal, 60 % WP).

For pot studies, round seedless variety (**Vitis vinifera** L. spp **sativa** var **sultana**), which has been widely grown in the region and sensitive to the pathogen was used.

Methods:

Three diseased samples were taken from 3 different localities in each of 8 provinces of Aegean Region during the first year. In the following years the samples were obtained only from 2 localities of the region where the one-site inhibitors were used intensively according to our observations. In this study total 32 **U. necator** isolates were used.

For stock cultures, the isolates were inoculated to the young leaves leaves and shoots (Childs, 1940; Jhooty, 1971). Inoculated plants were covered with polyethylene bags, which were patched with linen pieces and were kept in the isolated rooms (Yürüt, 1978).

To determine the sensitivity levels of the isolates, leaf-disc method was used (Brent, 1982). The chemicals were applied in 0, 1.0, 5.0 and 50.0 µg/ml a.i. concentrations in the first test, respectively. Although the less sensitive isolates were tested between the 50.0 µg/ml a.i. and 500.0 500.0 µg/ml a.i. with the increasing range of 10.0 µg/ml, the sen-

sitive isolates were tested between the 1.0 µg/ml a.i. and 10.0 µg/ml a.i. with the ranges of 1.0 µg/ml a.i. Evalutions were based upon minimum inhibitory concentration (MIC) values by observing the development of the powdery mildew colonies on leaf-discs (Sakurai, 1977).

For obtaining the effect of continuous fungicide applications on decreased sensitivity of **U. necator**, chemicals were applied as soil-drenching and as spraying methods in the pot experiments.

The isolate, which was the most sensitive to the chemicals, and showed very good development, was chosen for these tests. The drenchings were began from 1.0 µg/ml and after 13 applications, were increased to 30 µg/ml (Kovacs and Tüske, 1982). In sprays, beginning concentrations was also 1.0 µg/ml and were increased to 100.0 µg/ml, 36.0 µg/ml, 200.0 µg/ml, 600.0 µg/ml and 360.0 µg/ml for trisdimemefon, fenarimol, bupirimate, benomyl and carbendazim, respectively. Total 24 sprays were made with the intervals of 20-25 days by considering the disease severity. The sensitive isolate was inoculated onto leaves 48 hours after spraying according to the given method (Petsikos-Panayotarou, 1977). After 13 soil drenching and 24 spray applications fungicide sensitivity levels of treated isolates was determined by comparing with original untreated isolate.

Fitness of the less sensitive isolates were also studied. For this purpose 4 isolates (T-Ben, T-Car, S-Ben, S-Car), showing less sensitivity as a result of continuous application, untreated original sensitive isolates (Ç-16), and carbendazim resistant isolate (Al-Car) which was, obtained from the nature were used in these tests. The virulence, germination ability and spor production of isolates were determined as fitness criteris. All tests were conducted according to Dekker and Gielink (1979), de Waard (1971), Eckert (1982), Zaracovitis (1964) and Bouron (1974) under the non-fungicide conditions.

Stability of decreased sensitivity was tested under the pot conditions. In this study, 3 less sensitive isolates (S-Car, S-Ben and AL-Car) and one sensitive isolate were used to inoculate the test plants, and they were kept in separate cabins. After a certain period, MIC values were determined for each isolate.

To find out the importance of the less sensitive isolates in practice, one of the sensitivity-decreased isolate (S-Car) and untreated original isolate (Ç-16) were used. The plants were sprayed with carbendazim (180 µg/ml) and 48 hours following the spraying the isolates were inoculated or two separeted groups of these plants. Control plants were sprayed with water.

RESULTS

Fungicide sensitivity of the isolates:

Sensitivity levels of 32 **U.necator** isolates against the fungicides were summarized in Table 1.

Table 1. shows that the sensitivity levels of isolates against the triadimefon, fenarimol and benomyl were within the ranges of 1.0-50.0 µg/ml whereas the isolates which was inhibited by 210.0 g/ml dose of bupirimate showed a weak growth and disappeared shortly. This isolate was taken from a vineyard in Alaşehir (Manisa) which was exposed bupirimate applications. The isolate which was inhibited by 450.0 µg/ml carbendazim was taken from a vineyard of the same vicinity exposed carbendazim applications for several years.

Effect of continuous fungicide applications on decreased sensitivity of causel organism:

Drenching:

After 13 applications, the sensitivity levels of the isolates were summarized in Table 2. As it can be seen, sensitivity of isolates somewhat decreased against benomyl and carbendazim (T-Ben and T-Car).

Spraying:

In these experiments 24 applications were carried out and the results were summarized in Table 3. It can be seen that carbendazim and benomyl sensitivity of the isolates (S-Car, S-Ben) decreased rapidly. There was a tendency to decrease in sensitivity of the isolates (S-Tri, S-Fen, S-Bup) and cross-resistance was occurred only between benomyl and carbendazim.

Fitness of decreased sensitivity isolates:

The results were summariezed in Table 4. Disease severity, spore germination ratio and spore production values the isolates which showed different sensitivity against carbendazim and benomyl were almost similar to those values of original isolates. Length of germination tube showed very little increase as the sensitivity decreased.

Stability of decreased sensitivity:

Isolates (Al-Car, S-Ben, S-Car) with decreased sensitivity remained among the bud scales during a dormancy period and produced powdery mildew symptoms on new shoots. These isolates were tested according to MIC and it was determined that there was no change at

the level of sensitivity.

The importance of isolates with decreased sensitivity in practice:

The results were summarized in Table 5. Original isolate (Ç-16) has been ccntrolled by carbendazim but the isolate (S-Car) which is less sensitive has not been controlled by carbendazim.

DISCUSSION

In the first part of the experiments an isolate, less sensitive to bupirimate had a very poor growth. According to the studies with ethirimol these was a negative correlation between the pathogenicity and sensitivity. It is known that, bupirimate can transform to ethirimol in plant tissue (Davidse and de Waard, 1981). This can somewhat explain the reason, why the isolate acquired a high level resistance against bupirimate in nature and the reason of poor development. On the other hand, the isolate designated as Al-Cor also obtained from nature with considerably decreased sensitivity, did not lose its pathogenicity as stated in the literature (Dekker, 1977, 1982; Nagler et al, 1977).

In drenching studies the dose of fungicides progressively raised from 1.0 µg/ml to 30.0 µg/ml. The results showed that there was no changing in the sensitivity of the isolate Ç-16 against triadimefon, fenarimol and bupirimate. However, benomyl and carbendazim sensitivity decreased.

It was noticed that the sensitivity of isolates changed at the end of spray applications. Sensitivity of S-Car and S-Ben isolates decreased against carbendazim and benomyl respectively. Sensitivity of other isolates shower a tendency to decrease: S-Tri against triadimefon, S-Fen against fenarimol and S-Bup against bupirimate.

Previously it was reported that **U. necator** acquired resistance against benzimidazole group fungicides (Nagler et al, 1977, Pearson and Taschenberg 1980). **Sphaerotheca fulliginea** isolates obtained from greenhouses or fields showed somewhat decreased sensitivity against fenarimol, imazalil, triadimefon and triforin (Sheppers, 1983). Same organism showed decreasing sensitivity against benomyl and carbendazim of benzimidazoles and dimethirimol of hydroxypyrimidines also under the greenhouse conditions (Sheppers, 1984).

It was pointed out that changes in sensitivity to EBI's do not results full failure in the control (Sheppers, 1985).

The isolate with decreased carbendazim sensitivity (Al-Car) was

obtained from nature and other isolates with different sensitivity levels (S-Car, S-Ben, T-Car, T-Ben) which were obtained at the end of pot studies, were compared with the original sensitive isolate (Ç-16) from the fitness point of view. The results showed that there were no differences among the isolates tested. In earlier works, it was stated that benzimidazole resistant isolates show fitness as well as sensitive isolates (Sozzi and Gessler, 1980, Dekker 1982, Eckert, 1982).

Investigations on the stability of decreassing sensitivity of the isolates S-Ben, S-Car and Al-Car was suggested that decreasing sensitivity could be in a stabil character and it was also determined that there was a cross-resistance between carbendazim and benomyl resistant isolates. It was reported that although the risk of resistance was high, the decreasing sensitivity was stabil in benzimidazole compounds (Ogawa et al, 1976, Alexandri and Diaconu, 1978, Dekker, 1982) and cross-resistance occur within this group (Georgopoulos, 1982, Delen, 1980).

Recommended application dose of carbendazim did not control the isolate S-Car which acquired resistance against this fungicide but the dose was effective on original Ç-16 isolate. As it was reported before, **U. necator** was controlled at the rate of 97-100 % by benomyl for three succesive years but later it lost its effectiveness and pathogen and acquired resistance. The resistant isolates showed the same development as controls (Pearson and Taschenberg, 1980).

In the present work, it was established that **U. necator** isolates did not acquired a resistance yet against fenarimol, triadimefon and bupirimate. However, their sensitivities will certainly decrease as time goes on. Carbendazim and benomyl resistance have reached to the level causing a problem in their practical use.

In conclusion, in order to prevent or retard the formation of resistance on the **U. necator** populations, a strategical program should be followed for the application of onsite inhibitors.

ÖZET

EGE BÖLGESİNDE BAĞ KÜLLEMESİ (**Uncinula necator** «Schwein» Burr)'NİN FUNGİSİDLERE DUYARLILIĞI

Ege Bölgesindeki bağ alanlarından toplam 32 **U. necator** izolatı elde edilmiştir. Çalışmalarda, bu izolatların triadimefon, fenarimol, bupirimate, benomyl ve carbendazim'e duyarlılık düzeyleri saptanmıştır.

Teste alınan 32 izolatın duyarlılık düzeyleri en düşük engelleyici doz (MIC) değerlerine göre triadimefon, fenarimol ve benomyl'de 1.0 ile 50.0 μg/ml arasında, bupirimate'de 1.0 ile 210. 0 μg/ml, carbendazim'de 1.0 ile 450.0 μg/ml arasında bulunmuştur.

Doğada, devamlı carbendazim uygulanan bir bağdan bu fungiside duyarlılığı azalmış (MIC 450.0 μg/ml) bir izolat (Al-Car) elde edilmiştir.

Yapılan saksı denemelerinde, benzimidazole grubu fungisidlerin sürekli uygulanmalarıyla izolatların duyarlılıklarının azaldığı, ergosterol biyosentezi engelleyici (E.B.I.)'leri ve hydroxpyrimidine grubuna ise duyarlılıklarının azalma eğiliminde oldukları saptanmıştır. Ayrıca benzimidazole grubu fungisidler arasında çapraz-dayanıklılık (Cross-resistance) olduğu görülmüştür.

Benzimidazole'lere duyarlılığı azamlış izolatların duyarlılık azalışları ile doğaya uyum yetenekleri arasında pozitif bir ilişki bulunmuştur.

Carbendazime duyarlılığı azalan izolat (S-Car, MIC 400.0 μg/ml) saksı denemelerinde duyarlılığının azaldığı fungusidle kontrol edilememiştir.

Bağ küllemesinin dayanıklı populasyonlarının oluşmasını önlemek ya da geciktirmek açısından, tek yer engelleyici fungisidlerin kullanımını belli bir stratejiye oturtmak gerekmektedir.

Table 1. Sensitivity levels of 32 **U. necator** isolates against five fungicides

Name of Fungicide	Isolates		
	MIC value (μg/ml)	Number (s)	Total
Triadimefon	1.0—5.0	19	
	5.0—50.0	13	32
Fenarimol	1.0—5.0	20	
	5.0—50.0	12	32
Benomyl	1.0—5.0	17	
	5.0—50.0	15	32
Bupirimate	1.0—5.0	23	
	5.0—50.0	8	32
	210.0	1	
Carbendazim	1.0—5.0	14	
	5.0—50.0	17	32
	450.0	1	

Table 2. Sensitivity of **U. necator** against the fungicides at the end of 13 soil drenching applications

	Fungicides and MIC values (μg/ml)				
Isolates	Triadimefon	Fenarimol	Bupirimate	Benomyl	Carbendazim
T-Tri	3.0	3.0	3.0	3.0	3.0
T-Fen	3.0	3.0	3.0	3.0	3.0
T-Bup	3.0	3.0	3.0	3.0	3.0
T-Ben	3.0	3.0	3.0	10.0	10.0
T-Car	3.0	3.0	3.0	10.0	10.0
Ç-16	3.0	3.0	3.0	3.0	3.0

T-Tri: Triadimefon, T-Fen: Fenarimol, T-Bup: Bupirimate,
T-Ben: Benomyl, C-Car: Carbendazim drenched isolate,
Ç-16: Original isolate

Table 3. Sensitivity of **U. necator** against the fungicides at the end of 24 spray applications

	Fungicides and MIC values (μg/ml)				
Isolates	Triadimefon	Fenarimol	Bupirimate	Benomyl	Carbendazim
S-Tri	5.0	3.0	3.0	3.0	3.0
S-Fen	3.0	5.0	3.0	3.0	3.0
S-Bup	3.0	3.0	7.0	3.0	3.0
S-Ben	3.0	3.0	3.0	600.0	450.0
S-Car	3.0	3.0	3.0	600.0	400.0
Ç-16	3.0	3.0	3.0	3.0	3.0

S-Tri: Triadimefon, S-Fen: Fenarimol, S-Bup: Bupirimate,
S-Ben: Benomyl, S-Car: Carbendazim sprayed isolate.
Ç-16: Original isolate.

Table 4. Isolates showing different sensitivity levels against benomyl and carbendazim and their virulence germination ability and spore production ability under non-fungicide conditions.

Isolates	MIC values (μg/ml)	Disease seerity (%)	Spore germination ratio (%)	Length of germination (μm)	Spora production (spore/ml)
Al-Car	450.0	85,14	78,66	55,02 ∓ 1,77	$1,455x10^4$
S-Ben	600.0	84,0	78,0	53,12 ∓ 1,53	$1,45x10^5$
S-Car	400.0	87,41	79,33	51,95 ∓ 1,82	$1,50x10^5$
T-Ben	10.0	82,4	71,33	43,34 ∓ 1,26	$1,20x10^5$
T-Car	10.0	85,0	70,0	47,34 ∓ 1,45	$1,25x10^5$
Ç-16	3.0	87.0	79.66	43,60 ∓ 1,19	$1,35x10^5$

Ç-16: Original isolate

T-Car: Carbendazim, T-Ben: Benomyl dreched isolate

S-Car: Carbendazim, S-Ben: Benomyl sprayed isolate.

Al-Car: Carbendazim sensitivity decreased isolate was obtained from a vineyard which exposed continious carbendazim applications.

Table 5. Effect of carbendazim on isolates with decreased carbendazim sensitivity

Isolates	MIC values (μg/ml)	Fungicide and application dose (μg/ml)	Disease Severity (%)
S-Car	400.0	Carbendazim 180	87,72
S-Car	400.0	—	85,60
Ç-16	3.0	Carbendazim 180	87,72
Ç-16	3.0	—	87,0

S-Car : Carbendazim sprayed isolate

Ç-16 : Original isolate.

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Chemical Control of Bacterial Pustule in Soybean

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To control bacterial pustule in soybean, 12 chemical treatments were tried in artificially infested seeds. Three treatments viz; tetracycline (250 ppm), oxytetracycline (250 ppm) and hot water at 51°C for 15 minutes, though completely eliminated the bacterium but later 2 treatments adversely affected the seed germination. Maximum germination was obtained with thiram 3 g/kg seed but the control of disease was not as effective as with streptocycline (100 ppm). Under field conditions spray of chloromycetin (500 ppm) or mixture of streptocycline (200 ppm) plus fytolan (2500 ppm) proved most effective in controlling the disease as well as in increasing the grain yield.

INTRODUCTION

Bacterial pustule of soybean is a major disease caused by **Xanthomonas campestris** pv. **glycines** (Nakano) Dye. In India the grain yield losses owing to this disease have been reported as high as 18 per cent (Khare, 1986), whereas in other countries, the losses have been reported from 4.3 to 28 per cent (Weiss, 1950; Hartwig and Johnson, 1953; Weber **et al.** 1966 and Tereshchenko, 1977). Efficacy of fungicides, bactericides and antibiotics have been reported to control the disease and increasing the yield (Oksent'yan and Gunina, 1968; Kuzin and Serebrennikova, 1978; Srivastava and Bias, 1985 and Thapliyal and Dubey, 1986). The present investigation, therefore, was aimed to determine the effectiveness of different chemicals both under greenhouse and field conditions in controlling the disease.

MATERIALS AND METHODS

The seeds of susceptible soybean variety Punjab-1 collected from apparently healthy plants were used throughout the experiments. The inoculation with bacterial suspension (C.10^7 cells/ml) was done by soaking the seeds for 60 minutes and dried in shade. These seeds were again soaked for 2 hours in different solution of bactericides, fungicides and antibiotics. Dry seed treatment was done with non-systemic fungicides. This experiment was conducted in greenhouse during 1984.

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Observations on seed germination and per cent plant infected were recorded at 15 days and 30 days after sowing, respectively.

Experiments to judge the efficacy of different chemicals in controlling the disease, were laid out in field consecutively for two year i.e. Kharif 1985 and 1986 at Agricultural Research Station, Borkhera, Kota (Raj.) in randomoized block design having 4 replications. Forty days old plants were inoculated twice at an interval of 12 hours with bacterial suspension (c.10^7 cells/ml) with the help of 1 litre capacity hand sprayer. To ensure epiphytotic conditions for disease development, crop was kept moist for 2 days by spraying water. The chemical used in the tests were streptocycline (250 ppm), streptocycline (200 ppm), plus fytolan (2500 ppm), chloromycetin (500 ppm), ampicillin (250 ppm), plantomycin (250 ppm), tetracycline (250 ppm), oxytetracycline (250 ppm), agrimycin-100 (250 ppm), fytolan (2500 ppm), thiram (3000 ppm) and streptocycline (250 ppm) plus bavistin (2000 ppm). These chemicals were sprayed on inoculated plants after appearance of initial symptoms. In all, 3 sprays of each chemical were made at an interval of 10 days. Observations were recorded after 10 days of last spray on the basis of disease rating (0-5) scale:

0 = No infection.
1 = Leaves upto 10 % leaf area covered with minute spots.
2 = Leaves upto 11-25 % leaf area covered with pustules.
3 = Leaves upto 26-50 % leaf area covered with pustules.
4 = Leaves upto 51-75 % leaf area covered with pustules, some pustules confluent.
5 = More than 75 % leaf area covered with pustules, pustules mostly confluent, defoliation of foliage, spots on leaf petiole may or may not be present.

Infection index and percentage efficiency of disease control were calculated as per the following formulae (Wheeler, 1969).

$$\text{Infection index} = \frac{\text{Sum of individual rating}}{\text{No. of units assessed (Plant or leaves)}} \times \frac{100}{\text{Maxium disease rating}}$$

$$\text{Percentage efficiency in disease control} = \frac{\text{Infection index in control} - \text{Infection index in treatment}}{\text{Infection index in control}} \times 100$$

$$\text{Percent increase in yield} = \frac{\text{Yield in treatment} - \text{Yield in control}}{\text{Yield in control}} \times 100$$

RESULTS AND CONCLUSTION

In the experiments conducted in greenhouse, the seed treatment with tetracycline (250 ppm), oxytetracycline (250 ppm) and hot water treatment at 51°C for 15 minutes were found most effective in controlling the pathogen completely but later 2 treatments adversely affected the seed germination. Seed treatment with streptocycline (100 ppm) also resulted in good plant stand with lesser number of infected plants. Hence the results obtained reveals that seed treatment with tetracycline (250 ppm) or streptocycline (100 ppm) would be of more advantage in controlling seed borne infection (Table 1). Several workers namely Muras, 1964; Srivastava and Bias, 1985 have also advocated the effectiveness of various chemicals in eliminating seed borne infection of bacterial pustule in soybean. Poor seedling emergence from seed treatment with hot water reported by Thapliyal and Misra (1974) also correborates the present finding.

Streptocycline (200 ppm) plus fytolan (25000 ppm) followed by chloromycetin and fytolan were found most effective in controlling bacterial pustule during field trials of Kharif, 1985 and 1986, percentage of efficiency in disease control being 87.23, 70.80 and 66.72, respectively whereas, thiram was not as effective. Nevertheless, there was increase in seed yield in all the treatments as compared to untreated control and highest percentage of increase in yield were 34.48 and 29.84 in case of chloromycetin and streptocycline plus fytolan (Table 2). The results are in confirmity with those obtained by Thapliyal and Misra (1974), Srivastava and Bias (1985) and Thapliyal and Dubey (1986).

The results obtained from field trials revealed that when there was control of bacterial pustule, there was increase in yield but there was no correlation with infection index and yield. In some treatments particularly with antibiotics, there was increase in yield as compared to non-systemic fungicides. This may possibiliy be on account of effective control of disease and general improvement in plant growth.

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ÖZET

SOYA FASULYESİNDE BAKTERİYAL PÜSTÜL HASTALIĞININ KİMYASAL KONTROLU

Soya fasulyesinde bakteriyel püstül hastalığını kontrol etmek amacıyla, yapay olarak hastalandırılmış tohumlara 12 kimyasal uygulama yapılmıştır. Bunlardan tetracycline (250 ppm), oxytetracycline (250 ppm) ve 51°C'de 15 dakika süre ile sıcak suda bırakma adlı uygulamaların bakteriyi tamamen önlemesine karşın, son iki uygulamanın tohum çimlenmesini olumsuz yönde etkilediği bulunmuştur. En yüksek düzeydeki çimlenme, thiram (3 g/kg tohum) uygulaması ile elde edilmiş, ancak bunun hastalığın kontrolu açısından streptocycline (100 ppm) uygulaması kadar etkili olmadığı saptanmıştır. Tarla koşullarında chloromycetin (500 ppm) veya streptocycline (200 ppm) + fytolan (2500 ppm) karışımının bitkilere püskürtülmesinin dane verimini arttırmasının yanı sıra hastalığın kontrolünde de çok etkin olduğu belirlenmiştir.

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Table 1. Effect of chemical seed treatment on the development of bacterial pustule in soybean*.

S. No.	Treatment	Dose	Percentage of seed germinated	Plant infected (%)
1.	Streptocycline	100 ppm	79.16	5.6 (13.7)**
2.	Streptocycline	250 ppm	62.50	2.9 (9.8)
3.	Chloromycetin	500 ppm	60.00	29.4 (32.8)
4.	Ampicillin	250 ppm	69.16	17.5 (24.7)
5.	Erythromycin	250 ppm	77.50	19.4 (26.1)
6.	Oxytetracycline	250 ppm	54.16	0 (0)
7.	Streptocycline + Bavistin	250 ppm 2000 ppm	66.66	5.5 (13.6)
8.	Bavistin	2000 ppm	61.66	41.6 (40.2)
9.	Hot water treatment at 51°C for 15 minutes		37.50	0 (0)
10.	Mercuric chloride	2 k/Kg	85.83	7.3 (15.7)
11.	Tetracycline	250 ppm	75.83	0 (0)
12.	Thiram	3 g/Kg	94.00	22.5 (28.3)
13.	Inoculated seed	—	70.00	49.6 (44.8)
14.	Uninoculated seed	—	84.16	0 (0)
	S. Em			∓ 0.428
	C.D. at 5 %			1.213
	C.D. at 1 %			1.616

* Average of 2 experiments.

** Figures in paranthesis are angular transformed values.

Table 2. Effect of chemicals in controlling bacterial pustule in soybean after artificial inoculation with **Xanthomonas campestris** pv. **glycines.**

S. No.	Treatment	Conc. (ppm)	Infection index 1985	1986	Average	Percentage efficiency in disease control	Yield in g/ha 1985	1986	Average	Percent increase in yield
1.	Streptocycline	250	30.0 (33.2)	24.7 (29.8)	27.35	54.37	25.22	22.30	23.76	21.22
2.	Streptocycline plus Fytolan	200 2500	5.0 (12.9)	10.3 (18.7)	7.65	87.23	26.41	24.50	25.45	29.84
3.	Chloromycetion	500	15.0 (22.8)	20.0 (26.6)	17.50	70.80	27.80	24.93	26.36	34.48
4.	Ampicillin	250	20.8 (27.1)	25.3 (30.2)	23.05	61.55	24.03	22.90	23.46	19.69
5.	Plantomycin	250	23.5 (29.0)	36.1 (36.9)	29.80	50.29	25.56	23.04	24.30	23.97
6.	Tetracycline	250	26.3 (30.8)	29.1 (32.6)	27.70	53.79	23.81	21.85	22.83	16.47
7.	Agrimycin-100	250	26.3 (30.8)	32.3 (34.6)	29.30	51.12	24.57	23.50	24.03	22.60
8.	Oxytetracycline	250	24.3 (29.5)	27.0 (31.3)	25.65	57.21	23.37	22.40	22.88	16.73
9.	Fytolan	2500	21.3 (27.5)	18.6 (25.5)	19.95	66.72	23.80	22.65	23.22	18.46
10.	Thiram	3000	39.0 (38.6)	38.3 (38.2)	38.65	35.53	23.03	21.75	22.39	14.23
11.	Streptocycline plus Bavistin	250 2000	25.5 (30.3)	27.2 (31.4)	26.35	56.04	24.90	22.40	23.65	20.66
12.	Control	—	57.3 (49.2)	62.6 (52.7)	59.95	—	20.20	19.00	19.60	—
	S. Em		± 0.560	± 0.424			± 0.278	± 0.233		
	C.D. at 5 %		1.548	1.217			0.770	0.646		
	C.D. at 1 %		2.034	1.633			1.009	0.849		

In parenthesis are angular transformed values.

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Effect of Bean Common Mosaic Virus on the Growth and Yield of Cowpea (**Vigna unguiculata** (L.) Walp.)

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ABSTRACT

Bean Common Mosaic Virus (BCMV) significantly reduced the height, fresh and dry weights of shoot and root in comparison to health plants both under glasshouse and field conditions. The yield factor showed that the virus significantly reduced the number of pods per plant but not the number of seeds per pod under glasshouse and field conditions. This may be due to the fact that the total yield reduction in cowpea caused by BCMV was due to the difference in number of pods. There was non-significant difference between seasons and interaction of season and type for all the characters by the virus. The virus caused 76.7 % yield loss in cowpea cv. C-152 under the field conditions.

INTRODUCTION

Cowpea is cultivated in an area of 128.927 hectares in Rajasthan State. Like other crops, cowpea is also subjected to a number of diseases, among which viral diseases occupy an important place as they cause great loss in yield (Nene 1972). The viral diseases which are of common occurrence in cowpea cultivation are mostly known to be seed transmitted (Gupta and Summanwar, 1980). The virus under study was isolated from cowpea cv. C-152 and maintained on Jaipur Local Collection-A (JLC-A) as the virus titer was more in it. The virus was identified as BCMV. Hampton (1975) observed 50-64 per cent reduction in seed yield by BCMV infecting bean. The literature revealed that no detailed information is available about the losses caused by BCMV in cowpea, hence the studies were undertaken to find out effect of BCMV on growth and yield under glass house and field conditions.

MATERIALS AND METHODS

A) Glasshouse experiment: An inoculum was prepared by macerating the infected young leaves of cowpea cv. JLC-A with sterilized pestle and mortar in 0.1 M boric acid buffer (pH 7.5). The pulp was

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strained through fine muslin cloth and a pinch of celite powder was added as an abrasive. Inoculations were made on 50 seedlings of 10 day old cowpea cv. C-152 grown in 25 earthen pots (15 cm dia.). Fifty seedlings from 25 earthen pots smeared with 0.1 M boric acid buffer (pH 7.5) served as control. Twenty plants showing the symptoms of the disease at first trifoliate stage were tagged and harvested individually 80 days after sowing. For comparison, 20 control plants were also tagged and harvested individually. Seeds were dried at 25° - 30°C for 7 days and the final weight was determined. Various yield contributory characters viz. pods/plant, seeds/pod and seed weight/plant and comparison of healthy and diseased plants was done by comparing the average values by Fisher's small sample 't' test, At the time of harvest data on growth, fresh and dry weights of shoot and root were also recorded. The data were recorded as per the method described by Singh and Mall (1974). Dry weights of shoot and root were determined by drying in the oven maintained at 80°C for 36 hr. The per cent yield loss was calculated by the formula reported by Nene (1972).

$$Q = \frac{a - b}{a} \times 100$$

Where Q = per cent yield loss

a = average yield from 20 healthy plants

b = average yield from 20 healthy plants

B) **Field experiments:** With a view to study the extent of losses due to BCMV disease, seasons, and their interactions, field experiments were conducted in Kharif 1982 and Summer season 1983. The lay out of experiments in cowpea cv C-152 consisted of 25 rows of 3 m long with the spacing of 1 m between the rows. Before sowing, 1 kg diammonium phosphate per 100 m^2 was applied in rows. Twenty seds were sown in each row. Thinning was done one week after sowing in such a way that each row had 10 seedlings and plant to plant distance was maintained at 30 cm. Inoculations as per the proceduce described earlier were made twice to the plants in the odd rows. Plants in even rows smeared with boric acid buffer served as control. Half kg urea was applied to the plot 20 days after sowing. Randomly selected and tagged 25 plants infected by the virus were individually harvested 80 days after sowing. Equal nember of control plants were also tagged and harvested individually. Various yield contributory characters as mentioned earlier were recorded and healthy and diseased plants were compared by the average values of Fisher's small sample 't' test. At the time of

harvest, data on growth, fresh and dry weights of shoot and root were recorded as described earlier. The per cent loss in yield was calculated by the formula mentioned earlier.

RESULTS

A) **Glasshouse experiment:** The results of Table-1 indicate that the average height of diseased plants by the virus was significantly reduced which was 75.85 cm and 114.4 cm in diseased and healthy plants respectively. Fresh and dry weights of shoot were significantly reduced which were 7.93 g, 1.5 g and 12.55 g, 2.89 g in diseased and healthy plants, respectively. Fresh and dry weights of root were significantly reduced which were 4.04 g, 0.6 g and 7.06 g, 0.95 g in diseased and healthy plants respectively. Average number of pods produced by diseased plants was reduced which was 2.8 as compared to 4.2 in healthy plants. The number of seeds per pod produced was 7.55 and 8.9 by diseased and healthy plants respectively which was non-significant. The average yield was 1.58 g and 2.75 g from diseased and healthy plants respectively. The BCMV reduced the yield to 42.55 per cent when compared with healthy ones under glasshouse conditions.

Table 1. Effect of bean common mosaic virus on growth and yield of cowpea in glasshouse experiment

Character	Healthy plants[a]	Diseased plants[b]	't' value	Results[c]
Height of shoot (cm)	114.4	75.85	3.72	Significant
Fresh weight of shoot (g)	12.55	7.93	2.93	Significant
Shoot dry weight (g)	2.8	1.50	4.30	Significant
Fresh weight of root (g)	7.06	4.04	2.50	Significant
Dry weight of root (g)	0.95	0.60	2.10	Significant
Number of pods/plant (No.)	4.20	2.80	2.03	Significant
Number of seeds/pod (No.)	8.90	7.55	1.58	Not signi.
Seed weight/plant (g)	2.75	1.58	2.49	Significant

Table 't' Value at 38^{df}, 5 % probability = 1.69

a = Observations made on 20 healthy plants

b = Observations made on 20 diseased plants

c = Based on Fisher's small sample 't' test

B) **Field Experiment:** The results in Table-2 indicate that BCMV significantly reduced the height, fresh and dry weights of shoot and root in comparision to healthy plants. The yield factor showed that the virus significantly reduced the number of pods produced per plant but not the number of seeds per pod. The season had non-significant effect on all the characters studied in the experiment. The interactions between the seasons and BCMV disease had no significant effect on any of the characters studied.

DISCUSSION

The BCMV significantly reduced the height, fresh and dry weights of shoot and root in comparison to healthy plants under, the glass house and field conditions. Similar results have been reported by Harrison and Gudauskas (1968) for bean yellow mosaic virus infecting cowpea cv. Early Ramshorn.

The yield factor showed that the virus significantly reduced the number of pods produced per plant but not the number of seeds per pod. This may be due to the fact that the total yield reduction caused by BCMV was due to the differences in number of pods. The results are similar to ones reported by Kaiser and Mossachebi (1974) and Hompton (1975) for BCMV infecting bean. The results of Table 1 and 2 indicate that there was significant difference between healthy and disseased plants for all the characters except number of seeds/pod. There were non-significant difference between seasons and interaction of season and type for all the characters. The virus caused 42.55 % and 76.7 % yield loss in cowpea cv. C-152 under glasshouse and field conditions respectively.

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Table 2. Effect of Bean Common Mosaic Virus on growth and yield of cowpea in field experiment

Source	DF	Plant height (m)		Shot green wt (g)		Shoot dry wt (g)		Root green wt (g)		Root dry wt (g)		No. of pods/plant (No.)		No. of seeds/pod (No.)		Seed wt/ plant (g)	
		MSS	F cal.	MSS	F cal.	MSS	F cal.	MSS	F cal.	MSS	F cal.	MSS	F cal.	MSS	F cal.	MSS	F cal.
Season (Factor A)	1	10	0.1	61.3	0.1	65.3	1.6	0.8	0.2	0.0	0.0	18.5	2.5	1.0	0.1	0.3	0.04
Type (Factor B)	1	21756	218 *	20768	32.6 *	521	12.6 *	38	21.1 *	2.7	60.5 *	1056	140.4 *	16	2.3	797	92.5 *
A x B (Factor)	1	68.9	0.7	1183	1.8	17.3	0.4	1.3	1.4	0.2	4.1	30.3	4.0	3.7	0.5	1.3	0.3
Error SS	96	99.8	—	635.8	—	41.3	—	3.1	—	0.05	—	7.5	—	6.9	—	8.6	—
Total SS	99	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

* Denotes significance at 5 % level of probability

ÖZET

FASULYE ADİ MOZAYIK VİRUSU'NUN BÖRÜLCE (**Vigna unguiculata** (L.) Walp.) BİTKİSİNİN GELİŞMESİ VE VERİMİ ÜZERİNDEKİ ETKİSİ

Bu çalışmada, fasulye adi mozayık virusu (BCMV)'nun sera ve tarla koşullarındaki börülce bitkilerinin sürgün ve köklerinin uzunluğunu, yaş ve kuru ağırlıklarını önemli derecede azalttığı bulunmuştur. Verim faktörü, virusun sera ve tarlada bitki başına düşen bakla sayısını aşırı derecede olumsuz olarak etkilediğini, ancak bir bakladaki tohum miktarını azaltmadığını göstermiştir. Bu durum, börülce bitkilerinde adı geçen virus nedeniyle ortaya çıkan toplam verim azalışının, baklaların sayısındaki farklılıktan kaynaklanmasına bağlanabilir. Mevsimler ve mevsim interaksiyonu ile virus için dikkate alınan tüm karakterler arasında aşırı derecede önemli bir farklılık olmadığı saptanmıştır. Virusun tarla koşullarında C-152 adlı börülce çeşidinde % 76,7 oranında verim kaybına yol açtığı da belirlenmiştir.

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NEW RECORD

Vein Necrosis: New Viruslike Disease in Turkish Vineyards

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Vein necrosis was first reported from France (1). Later, it was found to be present in some regions of the USSR, (2, 4). Southern Italy and Bulgaria (3). The causal agent is unknown but considered to be viral because of graft transmissibility.

Vein necrosis is latent in all European grape cultivars and all American rootstocks except for **V. rupestris x V. berlandieri** 110 R. It causes extensive necrosis of the veins (especially those of second and third order), visible on the lower leaf blade. It also causes necrosis and dieback of young shoots and, occasionally death of infected plants. All of these symptoms observed on 110 R rootstocks in vineyards near the Horozköy/MANİSA, in spring of 1987. This symptoms are seen in field (Fig. 1), and second and third veins'necrosis on the lower leaf blade (Fig. 2).

ÖZET

Vein necrosis ilk defa Fransa'da rapor edildi. Daha sonra Rusya' nın bazı bölgelerinde, Güney İtalya ve Bulgaristan'da bulunmuştur. Neden olan etmen bilinmemekte fakat aşıyla taşındığından viral olduğu düşünülmektedir.

Vein necrosis, **V. rupestris x V. berlandieri** 110 R hariç diğer bütün Avrupa üzüm çeşitleri ve bütün Amerikan asma anaçlarında latenttir. Yaprağın alt tarafında görülebilen özellikle ikincil ve üçüncül damarlarda yoğun bir nekroza sebep olur. Nekroz, genç sürgünlerin ölümüne ve çok defa hasta bitkilerin de ölümüne neden olur. Bütün bu belirtiler 1987 yılı ilkbaharında Horozköy/MANİSA civarındaki bağlarda 110 R anaçlarında gözlendi. Bu belirtiler Şekil 1'de (arazide) ve Şekil 2'de (yaprağın alt tarafındaki ikincil ve üçüncül damarlardaki nekrozlar) görülmektedir.

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Fig. 1. Vein necrosis symptoms in the field.

Fig. 2. Second and third veins necrosis on the lower leaf blade.

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