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Investigations on the Effects of Various Soil Sterilization Types and Some Fungicides Used in Vegetable Seedbeds and Greenhouses to Soil Mycoflora in Ege Region [1]

1 - Seedbeds studies

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ABSTRACT

The present study has been conducted in order to determine the effects of several fumigants and a fungicide which were used in soil sterilization and also systemic fungicides used for control of powdery mildew on soil mycoflora. In addition to this effects of pesticides, the physical and chemical properties of soil were also examined.

Experiments were carried out in the vegetable seedbeds at Bornova Regional Plant Protection Research Institute and in Manisa.

In the consequence of these studies 42 fungi were determined and **Gelasinospora cerealis** Dowding is a new record for the mycoflora of Turkey.

INTRODUCTION

As known, the soil which is the source of agriculture and provides survival of microorganisms is a very comlex and a living system. In this system host plant, pathogen and microorganisms are in a natural balance. In many places a lot of pesticides have been used for various purposes in recent years.

The fact that fungicides, herbicides, nematocides and insecticides have been applied continuously to the soil and plants for the different purposes without considering their side-effects have destroyed the above mentioned balance. Actually, many workers reported that various sterilization types of soil with different pesticides effected soil microbiology (Katznelson and Richardson 1943, Warcup 1951, Kreutzer 1960, Mughogho 1968, Kaastra and Gams 1973, Warcup 1976, Rai and Tiwari 1977).

Applying the pesticides continuously, caused the change of soil na-

1 This study was supported by the Scientific and Technical Research Council of Turkey (Ankara—TOAG 364).

ture and at the as the result of this, some problems are born as soil-borne diseases, soil-tiredness and environmental pollution. Also, effects of fumigants and fungicides on the physical and chemical qualities of soil are reported in many papers (Page and Craddock (1965, Smith 1968, Hoper et al, 1971).

Especially in our country plant protection studies generally concerned with pathogen itself up to date. A few studies were reported on the effects of pesticide applications on soil microorganism besides the pathogen.

Several fumigants, fungicides used in soil sterlization and systemic fungicides used for control of powdery mildew were found to be effective on mycoflora by the present study. In addition to this effect of pesticides, the physical and chemical qualities of soil was also examined.

MATERIALS and METHODS

Methylbromide, Formalin, Brassicol-20, Benlate, Enovit-Super, soil samples, various laboratory means and necessities and chemical substances are the materials of this study.

Fumigants, fungicides and dosages used in the experiments are given in table 1.

Table 1. Tested chemicals and their dosages.

Name of the chemical	Percentage of the active ingredient	Dosages	
		m^2	100 lt water
Methylbromide (Dowfume MC-2)	Methylbromide 98 % Chloropicrin 2 %,	100 gr.	—
Formalin	Formaldehit 40 %,	300 cc	—
Brassicol 20	Pentachlora nitro benzene 20%	30 gr.	—
Benlate	Benomly «Methyl -1- (Butyl-carbomyl) -2- benzimidazole carbamate» 50 %	30 gr.	—
Enovit-Super	Thiophanate methyl, 70 %	—	40 gr.

Experiments were conducted according to Randomized Plot Design at Bornova Regional Plant Protection Research Institute and in Manisa.

In Manisa, the experiment was designed with four characters as Methylbromide, Formalin Brassicol-20 and control; at Institute, in addition to these chemicals Benlate, Enovit-Super Methylbromide + Benlate, Methylbromide + Enovit-Super, Formalin + Benlate, Formalin + Enovit-Super were used and the experiment was designed with 10 characters.

Methylbromide, Formalin and Brassicol-20 were applied before the seed sowing, systemic fungicides were used during the transplanting-stage of seedlings as transplant water and then three times with 15 days intervals as foliar sprayings.

Soil samples were taken from 0-15 cm depth of soil according to the Meredith's (1940) method for four times as follows: before applying Methylbromide, Formalin and Brassicol-20 to the soil; after applying and airing; and then one and two months later. In systemic fungicides, soil samples were taken three times, before applying and one week after applying as transplant water and one week after the foliar sprayings.

Soil samples were cultured as soil plate (Warcup, 1950) for all fungi, soil dilution plate for **Phytophthora** spp. (Johnson et al 1959) and trapping method for **Rhizoctonia solani** Kühn. (Papavizas and Davey, 1967). Peptone Dextrose Agar + Rose Bengal + Streptomycine + Penicilline medium used for all fungi, 1 % PDA + BNPRA and Water Agar media were used for **Phytophthora** spp. and **R. solani** respectively.

Mycoflora studies were conducted in the growth chamber at 24 $\mp$ 2 °C. Petri dishes were examined after three days of incubation and each fungal colony was marked on the bottom of the plate as soon as it appeared. Where fast growing fungi likely to overgrow and suppress slow growing ones, they were removed from the plates and cultured separately for later identification. All fungal colonies were counted, identified and recorded as number of colonies in per gr. air-dry soil.

Trapping method was employed for **R. solani**. Five pieces of a trap plant were placed into the dishes, in five replications. The percentage of **R. solani** was found by considering the average of five replications.

On the other hand, the soil samples were analysed from physical and chemical standpoint at Toprak-Su Bölge Müdürlüğü in Izmir.

RESULTS

Results of the experiments carried out at Bornova Plant Protection Research Institute: **Actinomucor, Alternaria, Aspergillus, Botryotric-**

hum, Botrytis, Cephalosporium, Chaetomium, Chrysosporium, Cladorrhinum, Cladosporium, Curvularia, Doratomyces, Fusarium, Gelasinospora, Gilmaniella, Gliocladium, Helminthosporium, Humicola, Melanospora, Myrothecium, Peacilomyces, Papulaspora, Penicillium, Phoma, Phytophthora, Pythium, Scopulariopsis, Sordaria, Stachybotrys, Stemphylum, Streptomyces, Thielavia, Trichoderma, Ulocladium, certain unknown fungi and genera belonging to the Mucorales order are isolated from the tomato seedbesds. **Aspergillus** spp., **Fusarium** spp., **Penicillium** spp., **Trichoderma** spp., **Gilmaniella** sp., **Doratomyces** sp., **Botryotrichum** sp., **Actinomucor** spp., dominant colonizers fungi in experiments.

Soil samples were taken periodically, as mentioned before, from the fumigants and fungicides applied tomato seedbeds, the total number of fungi were given in Figure 1 and 2, percentage of **R. solani** in Figure 3 and 4.

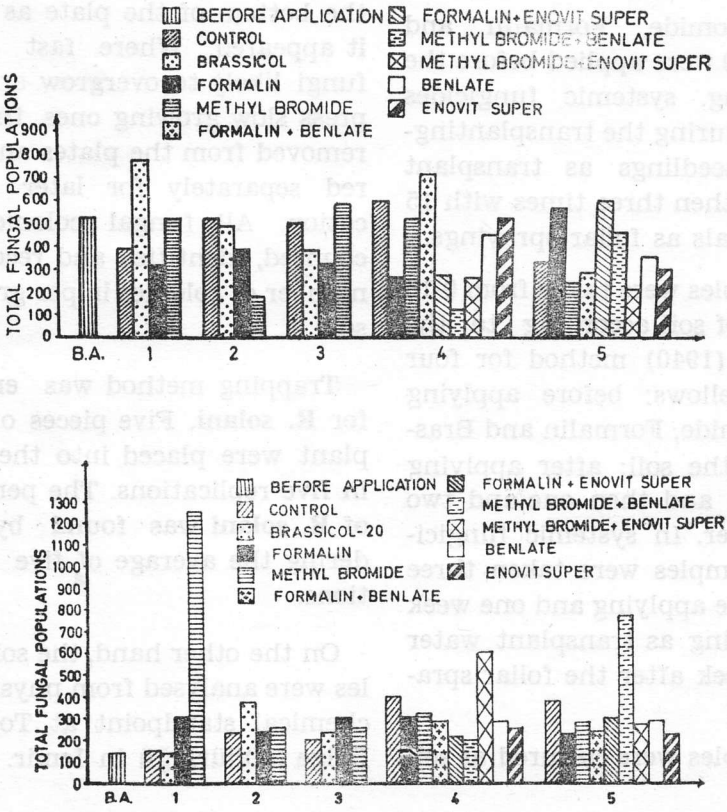

Fig.1-2. Total number of fungi in pesticide applied tomato seedbeds (Institute 1978-1979)

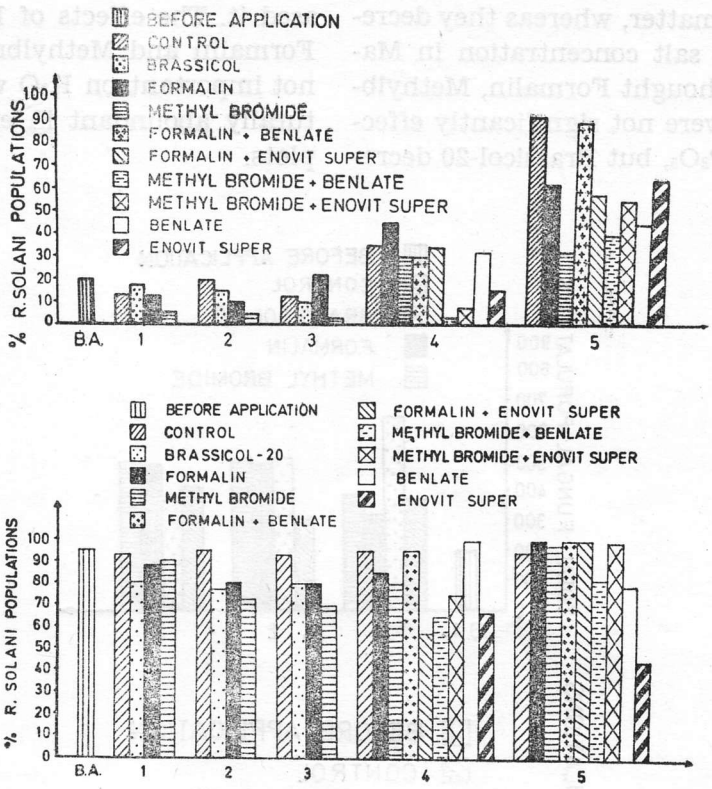

Fig.3-4. The percentage of **R. solani** in pesticide applied tomato seedbeds (Institute 1978-1979)

— Results of the experiments performed in Manisa: In our experiments with Brassicol-20, Formalin and Methylbromide in 1978 and 1979 **Actinomucor, Alternaria, Aspergillus, Botryotrichum, Botrytis, Cephalosporium, Chaetomium, Cladosporium, Cladorrhinum , Cylindrocarpon, Doratomyces, Fusarium, Gilmaniella, Gliocladium, Humicola, Macrophomina, Melanospora, Mortierella, Myrothecium, Papulaspora, Penicillium, Phoma, Scopulariopsis, Sordaria, Stachybotrys, Stemphylum, Thielavia, Trichoderma, Ulocladium, Verticillium,** sterile, certain unknown fungi and genera belonging to the Mucorales order were isolated from tomato seedbeds **Penicillium, Fusarium, Aspergillus** and **Actinomucor** genera took place in the first rows among them.

In tomato seedbeds which treated with pesticides, the total populations of fungi were given in Figure 5 and 6, percentage of **R. solani** in Figure 7-8, during 1978 and 1979.

In addition to this effect of pesticides, the physical and chemical properties of soil were also investigated.

Brassicol-20, Formalin and Methylbromide were not significantly effective on saturation, pH, lime and

organic matter, whereas they decreased the salt concentration in Manisa. Althought Formalin, Methylbromide were not significantly effective on P_2O_5, but Brassicol-20 decreased it. The effects of Brassicol-20, Formalin and Methylbromide were not important on K_2O which is naturally aboundant in experimental plots.

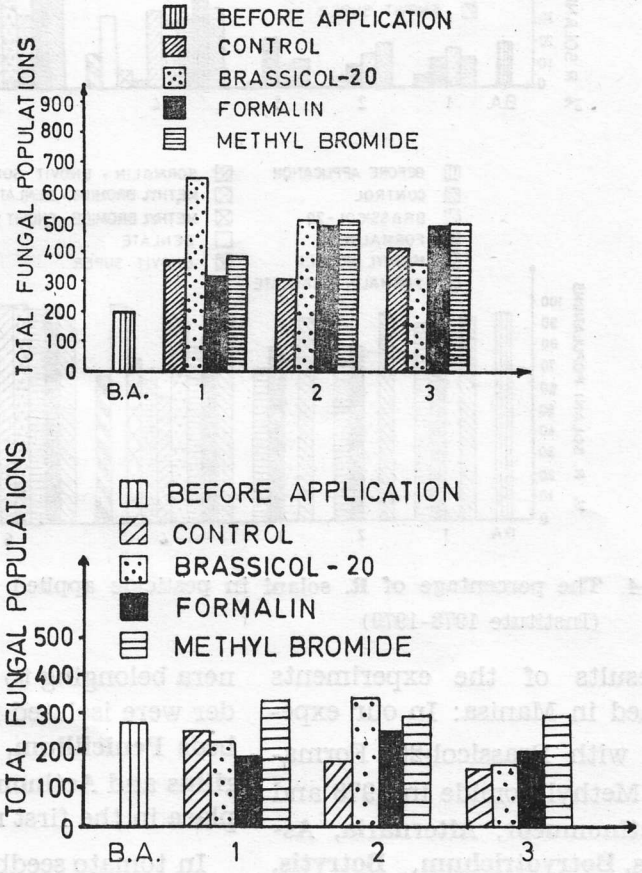

Fig.5-6. The total population of fungi in pesticide applied tomato seedbeds (Manisa, 1978, 1979)

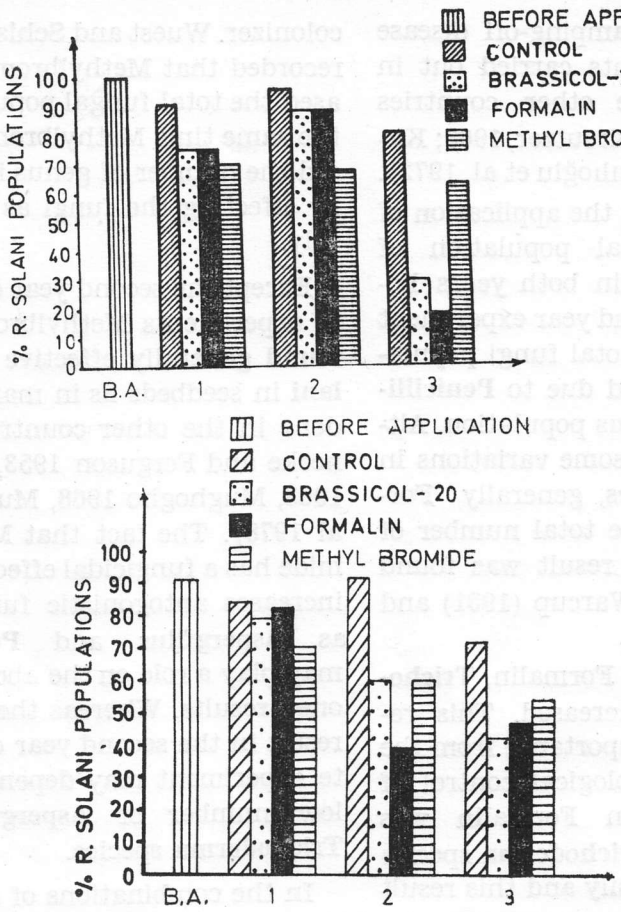

Fig.7-8. The percentage of **R. solani** in pesticide applied tomato seedbeds (Manisa, 1978-1979)

DISCUSSION

Soil sterilization was the most effective method for control of soil-borne plant pathogens and it was used successfully in many countries (Jancarik and Temmlowa, 1963; Kreutzer, 1963; Born, 1971).

Pesticides applied to soil have an effect on microorganisms as qualitative and quantitative and this results cause the change of the microbiological balance. The effects of these pesticides on mycoflora and soil fertility were as follows:

In all of the experiments in both years Brassicol-20 effected the soil mycoflora as qualitatively but not quantitatively. Total fungal flora increased in proportion to control because of the dominant colonizer of **Gilmanielle, Fusarium, Aspergillus** and **Penicillium** fungi. In both years in the same experiments the population of **R. solani** was found lower than the control. As a matter of fact, Brassicol-20 was known an effective pesticide in control of **R. solani** which was determined as the

main agent of damping-off disease in the experiments carried out in Turkey and the other countries (Kreutzer, 1960; Kreutzer, 1963; Karahan, 1972; Karcılıoğlu et al, 1972).

One week after the application of Formalin the total population of fungi decreased in both years however in the second year experiment at Institute the total fungi population was increased due to **Penicillium** and **Aspergillus** population. Although there are some variations in the other samples, generally Formalin reduced the total number of fungi. The same result was found in the studies of Warcup (1951) and Naumann (1970).

After applying Formalin, **Trichoderma** species increased. This result is of great importance from the standpoint of biological control of pathogens. When Formalin was applied to soil, **Trichoderma** species can recolonize easily and this result was found in many studies done by many workers in the other countries (Warcup, 1951; Kreutzer, 1960; Mughogho, 1968).

Formalin reduced the population of **R. solani** in both experiments. As a matter of fact the same results were found by Warcup (1951), Kreutzer (1960) and Jancarik and Temmlowa (1963).

Methylbromide increased the total number of fungi because of the dominant recolanized of some genera. This increase was due to the fact that **Botryotrichum** sp. **Penicillium spp.** in Institute, **Aspergillus** spp., **Fusarium** spp. and **Stachybotrys** sp. in Manisa were dominant recolonizer. Wuest and Schisler (1968) recorded that Methylbromide increased the total fungal population. At the same time Methylbromide reduced the number of genus in general, by effecting the fungi as qualitatively.

Except the second year of Institute experiments Methylbromide was found generally effective on **R. solani** in seedbeds as in many studies done in the other countries (Munnecke and Ferguson 1953, Kreutzer 1963, Mughogho 1968, Munnecke et al 1978). The fact that Methylbromide has a fungicidal effect and also increases antogonistic fungi such as **Aspergillus** and **Penicillium** may play a role on the above mentioned results. Whereas the different result in the second year of Institute experiment may depend on very low number of **Aspergillus** and **Trichoderma** species.

In the combinations of all the fumigants and systemic fungicides when they were used as transplant water they decreased the total fungal population, except in the first year. Formalin + Benlate increased the total number fungi because of the **Doratomyces** sp.

In the combinations of the fumigants and systemic fungicides as foliar sprays decreased the total number of fungi, but in the first year Formalin + Enovit Super and Methylbromide + Benlate increased the total population of fungi, causing an increase of **Penicillium, Fusarium** and **Penicillium, Fusarium, Alternaria** populations respectively.

When systemic fungicides were used alone, the application of Benlate and Enovit-Super as transplant water and foliar sprays generally decreased the total number of fungi in both years, but in the first year, the application of Benlate as foliar sprays increased the total population of fungi because of **Aspergillus**. As a matter of fact, Berg and Bollen (1971) Kaastra and Gams (1973), Faassen and Van (1974), and Oku et al (1979) reported that Benlate decreased the total population of fungi as in our study.

In the combinations of the fumigants and systemic fungicides Formalin + Benlate did not effect the population of **R. solani** in both of the applications. Methylbromide + Benlate, Methylbromide + Enovit Super decreased the **R. solani** populations in both of the applications. This result has a great importance from the point of view of being used widely in practice. Applying Benlate alone as trasplant-water did not effect the population of **R. solani**, but when it was used as foliar spraying and in both of the applications of Enovit-Super decreased **R.solani** populations. It was found that Benlate decreased **R. solani** population in many studies done by many workers (Allam et al 1969; Al-Beldavi and Pincard, 1970).

It was found that pesticides effected both soil mycoflora and physical and chemical qualities of soil in the other countries (Kreutzer, 1960; Page and Cradock 1965; Smith 1968; Hoper et al 1971).

In the present study Brassicol-20, Formalin and Methylbromide have not an important effect on saturation, pH, lime, organic matter and K_2O, but decreased the salt consantration in soil. As a matter of fact it was recorded that fumigants can change the salt as qualitatively and quantitatively (Kreutzer 1960). Brassicol-20 decreased the amount of the available P_2O_5 in soil, Formalin and Methylbromide have not an important effect on it. But Page and Craddock (1965) and Smith (1968) recorded that the fumigants increased P_2O_5 in soil.

Consequently, the data from the present study showed some variations in accordance with years and districts. It follows from this again that, actually, it is very difficult to decide on the soil fungi studies.

ÖZET

EGE BÖLGESİ SEBZE FİDELİK VE SERALARINDA UYGULANAN ÇEŞİTLİ TOPRAK STERİLİZASYON TİPLERİ İLE BAZI FUNGUSİTLERİN TOPRAK MİKOFLORASINA ETKİLERİ ÜZERİNDE ARAŞTIRMALAR

1. Fidelikte yürütülen çalışmalar: Bu çalışma, Ege bölgesi fideliklerinde toprak sterilizasyonunda kullanılan fumigant ve fungisit ile külleme savaşımında uygulanan sistemik fungisitlerin toprak mikoflorasına etkilerini saptamak amacıyla ele alınmıştır. Bunun ya-

nısıra kullanılan pestisitlerin toprağın fiziksel ve kimyasal özelliklerine etkileri de incelenmiştir.

Denemeler Bornova Bölge Zirai Mücadele Araştırma Enstitüsü deneme bahçesinde ve Manisa'da olmak üzere iki yerde açılmıştır.

Çalışmalar sonunda 42 fungus genusu saptanmıştır. Bunlardan **Gelasinospora cerealis** Dowding Türkiye mikoflorası için yeni fungustur.

Metilbromit ve Brassicol 20 uygulaması genellikle toplam fungus populasyonunu arttırdığı halde, Formalin ve fumigantların sistemiklerle kombinasyonu genellikle azaltılmıştır.

Metilbromit, Formalin ve Brassicol 20 saturasyon, pH, kireç, organik madde ve K_2O üzerinde önemli bir değişiklik yapmamalarına karşın, tuz konsantrasyonunu düşürmüşlerdir. Brassicol 20 topraktaki alınabilir P_2O_5 miktarını azalttığı halde, Formalin ve Metilbromit bu miktarda önemli bir değişiklik yapmamıştır.

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Leaf Spot of Sunflower (**Septoria helianthi** Ell. et Kell.) in the Black Sea Region of Turkey

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ABSTRACT

In the Black Sea Region of Turkey we first recorded this pathogen on 26 May 1980 on sunflower at Çınarlık village of Samsun and then in Tokat and Amasya provinces. The determination of this species was first made in Turkey by us according to the measurements of pycnidium and pycnispores as well as the other morphological characters, although the causal agent was previously observed in Thrace.

The disease was observed on sunflower variety Vınıımk 8931 in our experimental plots. The angular or sub-circular dark brown spots, in up to 2 cm diameter, developed on the leaves. Dark colored, subglobose and subepidermal pycnidia measuring, 109.71 x 125.76 micron in average developed on these spots.

There are many pycniospores in pycnidium. The pycniospores which are hyaline, granular, long, slender, straight or slightly curved and averagely with 3 septate measuring averagely 3.22 x 57.20 micron.

During summer both in 1980 and 1981 the disease failed to spread over large areas and its intensity remained below 1 % because of the unfvorable weather conditions for the development of the pathogen.

INTRODUCTION

In the Black Sea Region of Turkey, 16837 hectares of sunflower in 1977 (Anonymus, 1979). In recent years, it is estimated that the sunflower growing areas increased to a great extent.

Besides a number of sunlower diseases a new pathogen which is the causal agent of leaf spot of sunflower was found in the region.

Under the favorable climatic conditions an outbreak of this disease in the region seems to be likely in future. Hence, an extensive study on this disease should be carried out.

MATERIALS and METHODS

The field examinations were made in the experimental plots of the studies concerned with the downy mildew of sunflower **(P. helianthi)** at Çınarlık village in Samsun province (Özkutlu et al., 1980) and in the sunflower fields in Tokat and Amasya provinces. Microscopic examinations and pathogenicity tests were made in the laboratory. The finest vertical sections through the spotted areas of naturally infected sunflower leaves were prepared. The position, morphological and the other characters of pycnidium on the spots were examined under microscope through Colley solution (erythrocine), and they were measured and their photograph was taken. Using the same method the measurements of pycniospores inside the pycnidium were made, and their morphological characters and position inside the pycnidium, as well as the other characters were examined. A total of 300 pycnidia taken from the spots on diseased sunflower leaves and 300 pycniospores released from these pycnidia were measured.

RESULTS and DISCUSSION

We first recorded **Septoria helianthi** Ell. et Kell. on Vınıımk 8931 sunflower variety grown in the Black Sea Region of Turkey in May, 1980. This pathogen had been previously reported as **Septoria** sp. in Thrace by Yüceer and Karaca (1978). Therefore, the determination of this species has been first made in Turkey by us acording to the measurements of pycinidium and pysniospores, as well as the other morphological characters. Its presence and damage in the countries where sunflower is grown have also been reported by some authors (Laubert und Richter, 1932 and Roger, 1953).

It is concluded that this disease has been recently recorded by us possibly due to the fact that it gained entry to our region through imported sunflower seeds.

The early spots appearing on sunflower leaves at the cotyledon stage are 1 to 2 mm in diameter. Later they become angular or subcircular and attain to 2 cm in diameter. Sometimes many spots coalesce to form an irregular lesion on leaf surface (Figure 1). The leaf tissue around these dark brown or brown to black spots losses its green, color and turns light green or yellow. There are almost unvisible pycnidia distributed in the spots (Figure 2). The pycnidia embedded in tissue are dark colored and thick-walled, with ostioles projecting to the surface. These sub-globose pycnidia measure ranging from 84.00 to 192.50 x 77.00 to 150.50, on average 109.71 $\mp$ 0.23 x 125.76 $\mp$ 1.04 micron.

There are a considerable number of pycniospores in pycnidium. The-

se filiform hyaline pycnospores are long and slender and measure ranging from 2.10 to 4.20 x 28.00 to 86.00, on average 3.22 ∓ 0.03 x 57.20 ∓ 0.78 micron (Figure 3). The pycnospores are granular, straight or slightly curved, 1 to 6 septate (average 3.07 ∓ 0.11 septate) with both ends round.

The countings vere made during summer both 1980 and 1981 in some sunflower producing areas of Samsun, Tokat and Amasya provinces indicated that the intensity of the disease was below 1 %. It appears likely that in the future this pathogen may cause a considerable damage to sunflower depending on climatic conditions in our region where the sunflower growing area is getting larger and larger. Therefore, the studies on this subject should be initiated soon to avoid this possible thread.

ÖZET

TÜRKİYE'NİN KARADENİZ BÖLGESİNDE AYÇİÇEĞİ YAPRAK LEKE HASTALIĞI (**Septoria helianthi** Ell. et Kell.)

Türkiye'nin Karadeniz Bölgesinin ayçiçeği yetiştirilen tarlalarında bu patojene ilk kez 26.5.1980 tarihinde Samsun'un Çınarlık Köyünde, daha sonra da Tokat ve Amasya illerinde rastladık. Hastalık etmeni daha önce Trakya'da görülmüş ise de piknit ve pikniosper ölçülerine ve diğer morfolojik özelliklerine göre tür tespiti Türkiye'de ilk kez tarafımızdan yapılmıştır.

Hastalık, deneme parsellerimizdeki Vınıımk 8931 çeşidinde görüldü ve yapraklar üzerinde 2 cm'ye varan çapta, köşeli veya yuvarlağa yakın, koyu kahverengi lekeler oluşturdu. Bu lekelerin üzerinde koyu renkli ve küreye yakın biçimde, epidermisin altında, boyutları ortalama 109.71 x 125.76 mikron olan piknitler oluştu.

Piknitlerin içinde çok sayıda, renksiz, granüllü, ince, uzun, düz veya hafif kıvrımlı, boyutları ortalama 3.22 x 57.20 mikron, bölme sayısı ortalama 3 olan pikniosporlar bulunmaktadır.

1980 ve 1981 yaz mevsimi süresince hava koşulları patojenin gelişmesine uygun gitmediği için geniş alanlara yayılamamış ve ancak % 1'in altında bir yoğunlukta kalmıştır.

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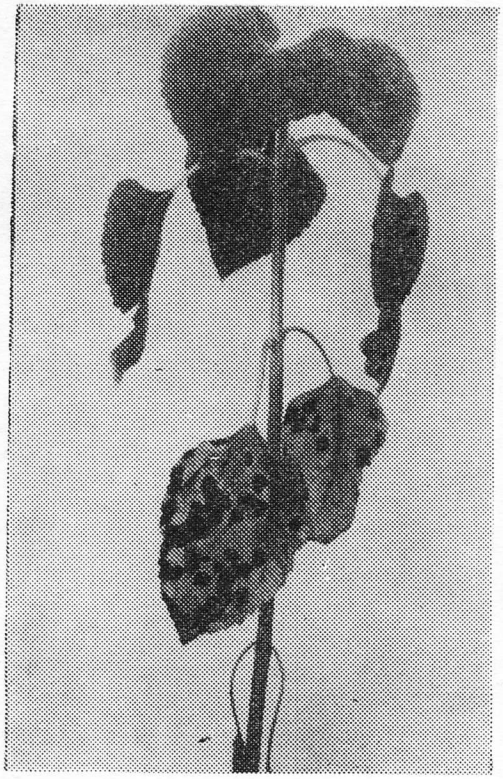

Fig.1. Natural infection on the sunflower leaves and the appearance of the leaf spots.

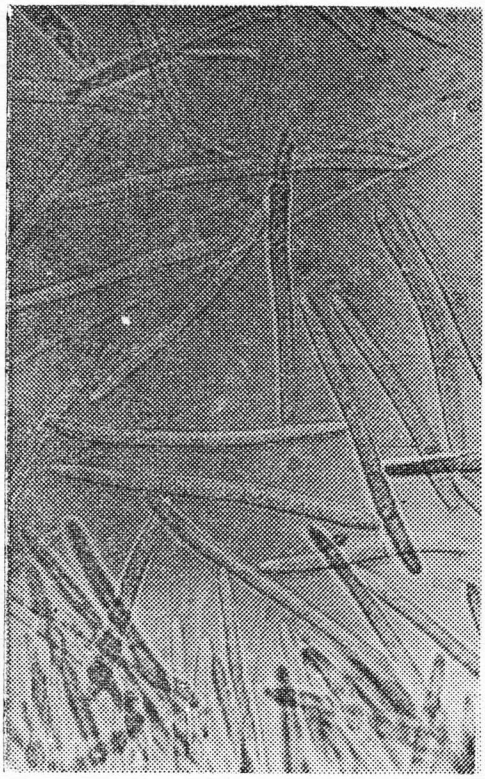

Fig.3. The pycniospores of **S. helianthi** (x1100).

Fig.2. Vertical dissection of the pycnidium of **S. helianthi** (x250).

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Buckeye Rot of Tomato as Influenced by Different Levels of N, P and K Fertilizers*

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ABSTRACT

The effect of applications of 100, 150 and 200 Kg N/ha in the form of Urea; 60, 90 and 120 Kg P_2O_5/ha in the form of Superphosphate and 15, 30 and 60 Kg K_2O in the form of Muriate of Potash on buckeye rot of tomato, caused by **Phytophthora nicotianae** var. **parasitica**, has been investigated under field conditions for three years. Higher levels of N resulted in higher yield of healthy fruits but fruit rot was also increased significantly. Higher levels of P resulted in more yield of healthy fruits and less fruit rot. Effect was more significant upto 90 Kg P_2O_5/ha. Different levels of K had very little effect on yield of healthy or diseased fruits except in the trial conducted during 1976.

INTRODUCTION

Among the different diseases of tomato (**Lycopersicon esculentum** Mill), buckeye rot caused by **Phytophthora nicotianae** B de Hann var. **parasitica** (Dast.) Waterh. has been reported to be the most severe causing heavy losses (Jain **et al.** 1961; Sharma 1971; Sohi, 1978) both in the field as well as in storage. Nutrition of the host has been reported to be one of the major factors which influence the development of various diseases directly or indirectly in many crops (Klotz **et al.** 1958; Pal and Grewal, 1976; Olunloyo and Adeniji, 1976; Bhowmik **et al.** 1976; Dasgupta and Chattopadhyay, 1977; Petrova and Dimitrov, 1976). Since there was no information regarding the effect of host nutrition on buckeye rot of tomato, studies were, undertaken to investigate the effect of different levels of N, P and K fertilizers on fruit rot and results are presented herein.

MATERIALS and METHODS

A field trial was laid out in July, 1976 and subsequently repeated in the same month in 1977 and 1978 to investigate the effect of diffe-

* Contribution No. 781 of I.I.H.R., Bangalore

rent levels and combinations of N, P and K fertilizers on buckeye rot of tomato. The soil of experimental plot was sandy-loam having pH value 6.8; available nitrogen 275 Kg N/ha; phosphorus 16.5 Kg P/ha and available potassium 260 Kg K/ha. The fertilizers and their doses used were:

N_1 — 100 Kg N/ha; N_2 - 150 Kg N/ha; N_3 - 200 Kg N/ha in the form of Urea

P_1 — 60 Kg P_2O_5/ha; P_2 - 90 Kg P_2O_5/ha; P_3 - 120 Kg P_2O_5/ha in the form of Superphosphate

K_1 — 15 Kg K_2O/ha; K_2 - 30 Kg K_2O/ha; K3 - 60 Kg K_2O/ha in the form of Muriate of Potash

All these nutrient elements were tried in a 3^3 randomized block design. Each treatment had 3 replication and each replication had a plot size of 5 x 3 sq. meter. Five-week-old seedlings of tomato cultivar 'Sioux' were transplanted on ridges and in all 40 plants were maintained in each plot. The basic dose of N_1 was applied along with different P and K combinations while the additional N was applied one month after transplanting. Two general sprays of incesticide (Sevin 0.3 %) were given before fruit set. The number and weight of diseased and healthy fruits in each plot were recorded separately at each picking. All the data were analysed statistically using variance technique (Panse and Sukhatme, 1967).

RESULTS

1. Effect on the yield of healthy fruits: Yield of healthy fruits in all the three years increased with the increase in nitrogen levels (Table 1). In all the experiments, the increase in yield was more when N levels were increased from 100 Kg N/ha to 150 Kg N/ha than with further increase of N levels to 200 Kg N/ha. Increase in yield from N_1 to N_2 level was statistically significant at both levels of significance in all the three trials, whereas further increase to N_3 levels resulted in significant increase in yield only in 1977 and 1978. Interactions of P x K, N x P and N x K also had significant effect on yield of healthy fruits in 1976 (Table 2).

Higher levels of phosphorous resulted in increased yield of healthy fruits in all the three trials. Increase in yield was significant at both levels of significance in 1976 and 1978 when P levels were increased from 60 Kg P_2O_5/ha to 90 Kg P_2O_5/ha whereas in 1977 increase was significant only when P levels were increased from 90 Kg P_2O_5/ha to 120 Kg P_2O_5/ha. Different levels of K increased the yield of healthy fruits in 1976 only and in subsequent years there was no effect of potassium on yield.

2. Effect on number of healthy fruits: Increasing levels of nitro-

gen resulted in corresponding increase in the number of healthy fruits in 1976 and 1977. Increase in the number of fruits was significant only at 5 % level in 1977 whereas in 1976 increase was significant only when nitrogen levels were increased from 100 Kg N to 150 Kg N/ha and further increase in nitrogen level did not increase the number of healthy fruits. During 1978, increase in number of fruits was significant when N levels were increased from N_1 to N_2 whereas further increase to N_3 resulted in decrease in the number of healthy fruits. Higher levels of phosphorous resulted in increased number of healthy fruits (Table 1). Increase was significant at both levels of significance when phosphorous levels were increased from 60 Kg P_2O_5 to 90 Kg P_2O_5/ha during 1976 and 1978 and further increase in phosphorous level did not results in significant increase in the number of fruits. During 1977, there was nonsignificant reduction in the number of fruits when phosphorous level was increased from 60 Kg P_2O_5 to 90 Kg P_2O_5 but further increase in phosphorous level to 120 Kg P_2O_5/ha resulted in significant increase in the number of fruits (Table 1). Interaction of N x K also had significant effect on number of the healthy fruits in 1976 (Table 2). Increasing levels of potassium increased the number of fruit in 1976 (Table 2). Increasing levels of potassium increased the number of fruits in 1976, the difference was significant between K_1 and K_2 only. In 1977 and 1978 the effect of K was not significant.

3. Effect on per cent weight of diseased fruits: Per cent weight of diseased fruits increased with increasing levels of nitrogen during 1977 and 1978. During 1976, weight of diseased fruits at 100, 150 and 200 Kg N/ha was 13.5, 17.25 and 15.45 per cent respectively (Table 1). The increase in fruit rot from N_1 to N_2 was significant at 5 % level of significance, whereas decrease in weight of diseased fruits with further increase in N levels was non-significant. In 1977 also, increase in fruit rot was significant at 5 % level when nitrogen levels were increased from 100 Kg to 150 Kg N/ha. In 1978 each higher level of nitrogen resulted in significant increase in fruit rot. Fruit rot was maximum at all the nitrogen levels in 1978 followed by 1977 and 1976. Increasing levels of phosphorous resulted in corresponding decrease in the weight of diseased fruits in all the three years. Interaction of N x P and P x K also had significant effect on yield of diseased fruits in 1977 (Table 2). Reduction in fruit rot was significant at both the levels when phosphorous levels were increased from 60 Kg to 90 Kg P_2O_5/ha and further increase in phosphorous, though reduced the fruit rot, but it was non-significant in all the trials. Increasing levels of K reduced the fruit rot in 1976 significantly. In 1977 decrease in fruit rot by K was found significant between 15 and 60 Kg K/ha only,

whereas in 1978 trial no significant effect of K was observed on weight of diseased fruits.

4. Effect on per cent number of diseased fruits: There was no significant effect of different levels of nitrogen on the number of diseased fruits in 1976 and 1977 but in 1978 each increasing level of nitrogen resulted in significant increase in the number of diseased fruits. Higher levels of phosphorous reduced the number of diseased fruits in 1976 and 1977 but reduction was significant only when phosphorous levels were increased from 60 to 120 Kg P_2O_5/ha in 1976 and 90 Kg P_2O_5/ha in 1977. In 1978 there was significant reduction in the number of diseased fruits when phosphorous level was increased from 60 Kg P_2O_5 to 90 Kg P_2O_5/ha and further increase in phosphorous level has not made any significant change in the number of diseased fruits. Higher levels of potassium reduced the number of diseased fruits significantly in 1976 and reduction in 1977 was significant only when potassium level was increased from 15 Kg K_2O to 30 Kg K_2O/ha. In 1978, there was no effect of different levels of potassium on the number of diseased fruits.

DISCUSSION

In the present studies higher levels of nitrogen increased the number and weight of diseased fruits whereas increasing levels of phosphorous reduced the fruit rot. Potassium reduced the fruit rot in 1976 but had very little effect in subsequent years. Similar findings in respect of nitrogen and phosphorous have been reported for buckeye rot of tomato (Sharma 1971), black shank disease of tobacco (Apple, 1961), **Phytophthora** root rot of roselle (Olunloyo and Adeniji, 1976), **Phytophthora** blight of pigeon pea (Pal and Grewal, 1976) smut of pearlmillet (Bhowmik **et al.** 1976), **Phytophthora** blight of Citrus (Klotz **et al.** 1958), powdery mildew of wheat (Petrova and Dimitrov, 1976) and brown spot of rice (Dasgupta and Chattopadhyay, 1977). Whether the increase in fruit rot with an increase in nitrogen level was due to (i) the effects on plant vigour that can influence the micro climate in a crop and so effect infection and sporulation of the pathogen or (ii) effects on cell walls and tissues, as well as biochemical make up of the host or (iii) effects on the pathogen through alterations in the soil environment could not be ascertained. However, nitrogen in the form of ammonium sulphate has been reported to support satisfactory growth of **P. nicotianae** var. **parasitica** in culture medium (Sharma, 1971). Moreover, it is not only the amount of nitrogen which would influence the disease development but also the form of nitrogen, its ratio with other nutrients and physical and chemical properties of the soil. Susceptibility of citrus seedlings to **Phytophthora citrophthora** and **P. parasitica** was greater with ammo-

nium sulphate or urea (47 and 59 %, roots infected, respectively) compared with fertilization with NO_3—N (3 % infected roots; Klotz et al. 1958). Since different researchers have used different sources of nutrients, different varieties and soil types, it is difficult to derive any conclusions. The red soils at the experimental site are quite rich in potassium and this might be the reason for poor response of potassium in the present studies.

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ÖZET

DOMATESLERDE BUCKEYE ÇÜRÜKLÜĞÜNÜN DEĞİŞİK SEVİYELERİNDEKİ N, P VE K GÜBRELRİNDEN ETKİLENMESİ

Domateslerde **Phytophthora nicotianae** var. **parasitica**'nın sebep olduğu buckeye çürüklüğüne 100, 150 ve 200 kg N/ha üre olarak; 60, 90 ve 120 kg P_2O_5/ha süper fosfat olarak ve 15, 30 ve 60 kg K_2O/ha Muriate potash olarak uygulanmasının etkisi tarla şartlarında üç yıl araştırılmıştır. Yüksek dozlarda N sağlam meyve ürününde artışa sebep olmuş fakat meyve çürüklüğü de önemli derecede artmıştır. Yüksek seviyelerde P sağlam meyve ürününü arttırmış ve meyve çürüklüğü de azalmıştır. Etki 90 kg P_2O_5/ha seviyede daha önemli olmuştur. Değişik seviyelerdeki K uygulaması hastalıklı ve sağlam domates ürünü üzerinde, 1976 yılındaki deneme hariç, çok az etkili olmuştur.

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Table 1 : Effect of different levels of N, P and K fertilizers on buckeye rot of tomato from 1976—1978

Treatments	Yield of healthy fruits (Kg/plot)			Number of healthy fruits			% weight of diseased fruits			% number of diseased fruits		
	A*	B*	C*	A	B	C	A	B	C	A	B	C
N levels (Kg N/ha)												
100	18.02	12.11	11.53	351.9	180.48	181.96	13.54	29.90	39.43	26.76	42.04	53.66
150	29.06	15.45	15.79	488.00	216.92	248.22	17.25	33.86	45.25	24.89	38.80	43.42
200	30.55	18.88	16.14	488.00	251.81	228.22	15.46	35.02	53.30	26.87	38.51	47.42
P levels (Kg P_2O_5/ha)												
60	20.21	14.13	12.57	379.56	201.51	196.37	18.88	37.63	52.36	27.92	41.98	51.12
90	28.57	14.57	15.32	462.67	199.18	227.55	14.33	32.24	43.01	26.24	41.19	45.55
120	28.58	17.75	15.57	476.19	248.51	238.48	13.03	28.92	42.69	24.16	36.18	47.83
K levels (Kg K_2O/ha)												
15	22.58	15.42	14.23	400.07	210.4	214.92	23.41	35.75	45.54	31.79	42.61	47.81
30	26.37	14.40	14.67	455.41	206.55	226.77	13.46	32.84	47.45	25.97	37.85	48.71
60	28.68	16.62	14.55	472.33	232.25	216.70	9.37	30.19	45.08	20.57	38.89	47.98
S.Em $\pm$	0.776	0.491	0.359	14.525	10.002	8.053	1.094	1.084	1.052	1.000	1.380	0.823
C.D. 5 %	2.205	1.395	1.020	41.251	28.407	22.872	3.108	3.079	2.987	2.839	3.921	2.338
C.D. 1 %	2.939	1.860	1.360	54.996	37.872	30.492	4.143	4.104	3.983	3.786	5.227	3.119

* A. 1976; B. 1977; C. 1978

Table 2 : Effect of interaction of NP, NK and PK on buckeye rot of tomato

A. Effect on weight of healthy fruits in 1976

	P_1	P_2	P_3	Mean
N_1	14.09	19.20	20.77	18.02
N_2	20.95	34.87	31.34	29.05
N_3	25.60	31.64	34.42	30.55
Mean	20.21	28.57	28.84	

	K_1	K_2	K_3	Mean
N_1	16.00	18.91	19.14	18.01
N_2	23.08	30.51	33.58	29.05
N_3	28.65	29.68	33.33	30.55
Mean	22.57	26.36	28.68	
P_1	18.93	20.21	21.50	20.21
P_2	22.90	30.05	32.76	28.57
P_3	25.89	28.85	31.79	28.84
Mean	22.57	26.37	28.68	

S.Em $\pm$	1.3449
C.D. 5 %	3.891
C.D. 1 %	NS

B. Effect on number of healthy fruits in 1976

	K_1	K_2	K_3	Mean
N_1	319.33	389.55	346.88	351.92
N_2	405.44	514.00	544.33	487.92
N_3	475.44	462.66	525.77	487.95
Mean	400.07	455.40	472.32	

S.Em $\pm$	25.159
C.D. 5 %	71.450
C.D. 1 %	NS

C. Effect on per cent weight of diseased fruits in 1977

	P_1	P_2	P_3	Mean
N_1	31.08	30.79	27.85	29.90
N_2	42.61	32.02	26.97	33.86
N_3	39.19	33.91	31.95	35.01
Mean	37.62	32.24	28.92	
K_1	43.93	35.85	27.48	35.75
K_2	35.34	31.39	31.79	32.84
K_3	33.60	29.47	27.50	30.19
Mean	37.62	32.23	28.92	

S.Em $\pm$	1.877
C.D. 5 %	5.333
C.D. 1 %	NS

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Vergleichende Untersuchungen über die Anwendungsmöglichkeiten von Milch und Capsicumpresssaft zum Schutz von Tomatenpflanzen gegen Tomatenmosaik

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ZUSAMMENFASSUNG

In dieser Arbeit wurden 21 Tage alte Tomatenpflanzen der Sorte Foma mit Magermilch, Paprikapresssaft und als Kontrolle mit Wasser gespritzt. Für jede Behandlung wurden die zufällig herausgezogenen zweiunddreissig Tomatenpflanzen mit Milch + TMV, Paprikapresssaft + TMV und Wasser + TMV (Kontrolle) inokuliert.

Um die Auswirkung der Behandlungen auf die Virusvermehrung quantitative zu erfassen, wurden die Pflanzen 21 Tage später einzeln geerntet. Der grüne Teil jeder Pflanze wurde in Phosphat-Puffer zermörsert und für jede Tomatenpflanze 10 **Nicotiana glutinosa** Blätter inokuliert. Die Hemmwirkung wurde in % der Kontrolle gerechnet. Die Hemmwirkung von Capsicumpresssaft beträgt 84,31 % vergleichbar mit der Hemmwirkung von Magermilch mit 85,37 %.

Weil die Milchpreise in der Türkei verhältnismässig hoch und für die Behandlungen mit Paprikapresssaft keine Mehrausgaben notwendig sind, kann der Paprikapresssaft grosse Bedeutung in der Praxis gewinnen.

EINLEITUNG

Tabakmosaikvirus ist am leichtesten mit Kontakt übertragbares Virus unter den Pflanzenviren und ausserdem hat es einen sehr breiten Wirtspflanzenkreis. Mosaikkrankheit der Tomate wird durch verschiedenen Virusstämme verursacht, die auf Tomaten spezialisiert sind. Während der Tomatenanzucht in Gewächshäusern ist die Verseuchung der gesunden Pflanzen unvermeidlich vor allem bei dichter Pflanzung, Pikierung und anderen Pflegemassnahmen. An Freilandtomaten sind fast alle Pflanzen virusinfiziert, weil die Ausbreitung der Viren durch unspesifische Vektoren und Luftbewegungen erhöht

wird. Deswegen spielen die Verhütungsmassnahmen zum Schutz der Pflanzen gegen Virusinfektionen eine wichtige Rolle, da andere Pflanzenschutzmethoden keinen ausreichenden Erfolg haben. Magermilchspritzung ist eine von diesen Verhütungsmassnahmen und wurde gegen zahlreiche Viren mit Erfolg angewendet.

Hare (1959) fand die Milchbehandlungen vor der Inokulation bei Tabakmosaikvirusinfektionen besonders erfolgreich. Nach Lucas und Hare (1959) sind alle Proteinfraktionen von Milch, Molke und Blutserum mehr oder weniger Virushemmstoffe. Mit Milchbehandlungen an Tomaten und Gurkenkulturen gegen Tabakmosaikvirus, Kartoffel Virus X und Gurkenmosaikvirus 1 und 2 wurden gewisse Erfolge erzielt (Jaeger, 1966). Unter den Milcharten hat die Magermilch die beste Wirkung und ausserdem kann man sie mit anderen systemischen Inzektiziden und Maisöl gemischt anwenden (Hein, 1961; 1964; 1975).

In den letzten Jahren haben die pflanzlichen Hemmstoffe immer mehr an Beachtung gewonnen und in mehreren Versuchen wurden mit Capsicumpresssaft befriegende Erfolge erzielt. Capsicumsaft enthält besonders proteinartige und fenolische (flavon und isoflavon) Hemmstoffe (Mc Keen, 1956; Marchoux, 1967; Rangoonwala und Friedrich, 1967; Apaplaza und Bernier, 1972; Fischer und Nienhaus, 1973; Erkan, 1982).

In dieser Arbeit wurden vergleichende Untersuchungen zur Hemmwirkung von Magermilch und Capsicumsaft durchgeführt.

MATERIAL und METHODEN

Das Material bestand aus einem Tometanmosaikvirusisolat Kemalpaşa (Yorgancı, 1978), Paprikapflanzen, Magermilchpulver von Pınarsüt Anonymgesellschaft und der Tomatenpflanzen der Sorte Roma. Jeweils 4 Töpfe 21 Tage alter Tomatenpflanzen wurden bei jeder Versuchsserie mit Magermilch (100 g Magermilchpulver in 1 Liter Wasser gelöst) mit Paprikapresssaft (in Verhältnis 1 : 1 mit Wasser verdünnt) und als Kontrolle mit Wasser gespritzt. Zufällig herausgezogenen zweiunddreissig Tomatenpflanzen wurden umgepflanzt und sie wurden mit Milch + TMV, Paprikapresssaft + TMV und Wasser + TMV inokuliert. 21 Tage nach dieser Behandlung wurden die Pflanzen einzeln geerntet und der grüne Teil jeder Pflanze wurde in 10 ml Phosphat-Puffer 0,01 M pH 7.0 zermörsert.

Um die Auswirkung von Behandlungen auf die Virusvermehrung in Tomatenpflanzen quantitative zu erfassen, wurden **Nicotiana glutinosa** Pflanzen alt Testmaterial verwendet und für jede Tomatenpflanze zehn **N. glutinosa** Blätter inokuliert. Die inokulierten Blätter

wurden in Petrischalen in die Klimakammer gelegt und nach drei Tagen wurden die entstandenen Lokalläsionen gezählt. Die Hemmwirkung wurde in % der Kontrolle gerechnet.

ERGEBNİSSE und DISKUSSION

Die Ergebnisse der Versuche wurden in Abbildung 1 zusammengefasst.

Abbildung 1. Die Hemmwirkungen von Magermilch und Capsicumpresssaft auf TMV-Infektion an Tomaten.

Behandlung	n	Gesamtzahl der entstandenen Lokalläsionen	Mittelwerte	Hemmwirkung in %	L.S.D** p=0,05
Wasser (als Kontrolle)	32	12.995,30	406,10 (211,2 - 271,8*)	0	a
Paprikapresssaft	32	2038,50	63,70 (13,5 - 129,3)	84,31	b
Magermilch	32	1899,00	59,34 (22,6 - 134,0)	85,37	b

* Der niedrigste und der höchste Wert ist in Klammernangegeben.
** L.S.D (p=0,05) = 79,71

Wie aus der Abbildung zu ersehen ist, beträgt die Hemmwirkung von Capsicumpresssaft 84,43 % vergleichbar mit der Hemmwirkung von Magermilch mit 85,37 %. In unseren Versuchen konnten wir durch Milch-und Paprikasaftspritzungen hohe Hemmwirkung gegen TMV erzielen. Ähnliche Ergebnisse berichten auch anders Autoren.

Milchspritzungen wurden auch in Freilandkulturen an Tomaten mit Erfolg angewendet und dadurch wurde der Befall hinausgeschoben. Nach Jaeger (1966) wurde der entsprechende Befallsgrad behandelter Pflanzen ungefähr einen Monat später erreicht, wodurch mehr Ertrag erzielen wurde.

In der Türkei bzw. in der Çukurova Region wurden die Paprikafplanzen vor jedem Arbeitsgang im Freiland sowie im Gewächshaus mit Magermilch gespritzt und dadurch wurde 20,4 % Mehrertrag erzielt (Tekinel et al., 1972). Weil die Milchpreise in der Türkei verhältnismässig hoch sind, konnte man trotz des Mehrertrags keinen beachtenswerten Gewinn erzielen. Deswegen kann der Paprikapresssaft grosse Bedeutung in der Praxis gewinnen, da für diese Behandlungen keine hohe Ausgaben notwendig sind.

Ö Z E T

SÜT VE BİBER ÖZSUYUNUN DOMATES BİTKİLERİNİ DOMATES MOZAYIĞINDAN KORUMA AMACIYLA KULLANIM OLANAKLARI ÜZERİNDE KARŞILAŞTIRMALI ARAŞTIRMALAR

Bu araştırmada 21 günlük Roma domates çeşidi fidelerine yağsız süt, biber özsuyu ve su püskürtülmüştür. Her uygulama için, tesadüf ilkesine göre sökülmüş 32 fide saksılara dikilmiş, yağsız süt + TMV, biber özsuyu + TMV ve Su + TMV (kontrol) ile inokule edilmişlerdir.

Uygulamaların virus çoğalması üzerine etkisini, nicesel olarak saptamak amacıyla, bu işlemden 21 gün sonra bitkiler tek tek hasat edilmiş, her bitkinin yeşil kısmı havanda fosfat tamponu eklenerek ezilmiş ve 10 **Nicotiana glutinosa** yaprağına inokule edilmiştir.

Kontrola oranla, biber özsuyu ile % 84,31, yağsız sütle % 85,37 engelleme saptanmıştır.

Türkiye'de süt fiatlarının yüksek olması nedeniyle ve fazla bir masraf gerektirmediği için biber özsuyu kullanımı, uygulamada önem kazanabilir.

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Changes in Enzymatic Activity of Pumpkin Plant infected with Watermelon Mosaic Virus*

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ABSTRACT

Experiments were carried out to see the effect of a strain of watermelon mosaic virus (WMV) on the enzymatic activity of pumpkin **(Cucurbita maxima)** plants. The data revealed that catalase activity increased in both healthy and WMV infected plants with the age of the plant upto 60th day and declined thereafter. The activity, however, in diseased leaf samples was always lower than their healthy counterparts. The maximum catalase activity was recorded at 60th day of inoculation. Nitrate reductase activity in general, increased in WMV infected leaf, stem and root. The infected leaves showed maximum enzyme activity. Highest activity was recorded at 60th day of inoculation and decrease thereafter. The activity of the enzyme invariably increased with an increase in the age of the plants.

INTRODUCTION

Pumkin (**Cucurbita maxima** Duch.) is one of the important and popular vegetables in India. During 1979 a very severe virus disease, causing mosaic symptoms in pumpkins was observed. The causal virus was identified as a strain of watermelon mosaic virus-1 (WMV-1) (Singh, 1979). Since the virus causes a great deal of losses in quality of fruits, it was thought necessary to work out the effect of this virus on enzymatic activity of the host plant. The results are communicated here.

MATERIALS and METHODS

For studying the enzymatic activity in virus-infected pumpkin plants, seeds of pumpkin var. «Arka Suryamukhi» were sown in 12 inch earthen pots in the glasshouse. At one time leaf stage plants were inoculated mechanically with the virus (WMV-1). Leaf samples for

* Contribution No. 129/82 of Indian Institute of Horticultural Research, 255, Upper Palace Orchards, Bangalore-560080, India.

enzymatic activity were collected at the intervals of 15, 30, 45, 60 and 75 days after inoculation.

Two enzymes were estimated (1) Catalase (2) Nitrate reductase. The Catalase activity of the leaf samples was measured by the method of Dekock **et al.** (1960) with slight modification. For preparing the enzyme, 1 g of leaf sample was crushed in chilled mortar with 10 ml of phosphate buffer (pH 6.8) and a pinch of acid washed sand. The homogenate was made to 25 ml with glass distilled water. At zero time, 1 ml of homogenate was pipetted separately into a series of flasks, each containing 5 ml of 1.5 % sodium perborate and 1.5 ml of phosphate buffer (pH 6.8). The reaction was stopped in successive flasks after 1, 2, 3 and 4 min. by rapidly adding 10 ml of NH_2SO_4. The perborate left into the mixture was titrated with 0.05 N $KMNO_4$ for first pink colour which lasted for 30 seconds. The quantity of $KMNO_4$ consumed was recorded and the activity of catalase was calculated according to the following formula of Patterson (1956).

$$r = \frac{4Y_4 + 3Y_3 - Y_2 - 6Y_1}{4Y_3 + 3Y_2 - Y_1 - 6Y_0}$$

where Y_0, Y_1.... Y_4 are values of $KMNO_4$ used for flasks in which the reaction was arrested at 0, 1.... 4 min. respectively.

$K = \log 10^r$ where K = constant

A = activity in units of fresh wt.

W = fresh weight of material in gm.

Nitrate reductase activity was measured by the method described by Srivastava (1974). Five fundred mg of fresh plant sample (of same age) from both healthy and diseased plants were taken. The samples were incubated separately in test tubes containing incubation mixture in dark at 30°C. The incubation mixture of each test tube contained 0.1 M potassium nitrate and 1.0 ml 5 % n-propanol. After 30 min., 0.1 ml of incubation mixture was taken and 1.0 ml each of sulphanilamide (1 per cent sulphanilamide in 1 N HCI and 2-naphythyl ethylene diamine dihydrochloride (0.02 %) were added and the optical density was read after 10 min at 540 nm in Spectrophotometer. Afterwards the incubated material was crushed in distilled water and the volume was made to 50 ml before centrifuging it at 10,000 g. To the 1.0 ml of clear supernatant, 1.0 ml of sulphanilamide and 1.0 ml of naphthyl ethylene dihydrochloride solutions were added and OD was read as above.

The total NO_2 produced per hour (h) and per g fresh weight of the same was calculated by adding the NO_2 yield of the two solutions which is determined by matching

the two O.D. reading with a standard curve prepared with different dilutions of sodium nitrate solution.

RESULTS

The details of the results have been furnished in tables 1 and 2. Catalase activity in both healthy and diseased samples increased with the age of the plant upto 60th day of inoculation and then it declined. The activity, however, in diseased leaf samples was always lower than their healthy counterparts. The maximum catalase activity was noticed in healthy leaf samples on 60th day following inoculation (table-1).

Results presented in table 2 indicate that in general there was an increase in the nitrate reductase activity in diseased samples (leaf, stem and root). The maximum activity of this enzyme was observed in the leaf followed by root and stem. Highest activity was recorded at 60th day of inoculation and thereafter the activity of the enzyme invariably decreased with the increase in the age of the plants.

Table—1 : Catalase activity (unit/g fresh wt.) of pumpkin leaves at different periods of virus infection*

Days after inoculation	Catalase activity	
	Healthy	Infected
15	1.10	1.05
30	1.25	1.16
45	1.32	1.21
60	1.36	1.27
75	1.26	1.22

* Average of 3 experiments.

Table—2 : Nitrate reductase activity (n-moles of NO_2h^{-1} g^{-1} fresh wt.) of pumpkin plant parts at different periods of virus infection*

Days after	Leaf		Stem		Root	
inoculation	Healthy	Infected	Healthy	Infected	Healthy	Infected
15	1078	1280	750	820	890	995
30	990	1008	731	786	810	880
45	885	975	618	770	779	830
60	808	856	550	606	700	802
75	790	850	542	580	680	785

* Average of 3 experiments.

DISCUSSION

In the present investigations lower catalase activity was observed in pumpkin leaves infected with WMV as compared to healthy ones. Similar decrease in the activity of enzyme was observed in tobacco plants infected with Tobacco mosaic virus (TMV), (Hills and Mc Kinney, 1942, Vager, 1975), in chilli infected with Potato virus (PVY) (Jeyarajan and Ramakrishnan, 1972); und Urd bean infected with urd bean mosaic virus (Singh and Mall, 1973).

It is customary to class catalase among the respiratory enzyme although its real function is poorly understood as yet (Kiraly and Farkas, 1959). According to Yamafugi **et al.** (1943) in virus infected tissues, at least part of the catalase molecule is incorporated in the virus protein and the catalase thus incorporated can show its action only after the virus is split under suitable conditions. In the present studies the decrease in catalase activity may also be due to the incorporation of catalase molecules into virus proteins.

Increased nitrate reductase activity in virus-infected plant parts has also been reported by Parthasarathi **et al.** (1962) in spike disease of Sandal; Narayanaswamy and Ramakrishnan (1966) in pigeon pea affected with Sterility mosaic virus and Khatri and Chenulu (1973) in cowpea infected with Cowpea mosaic virus.

The higher activity of nitrate reductase in infected plant indicates the enhanced rate of nitrogen assimilation, due to accelerated protein synthesis in virosed plants. The higher levels of nitrite nitrogen (Singh, 1979), in virus infected pumpkin plants indicate that nitrogen absorption from the soil was accelerated and it was ultimately converted into utilizable form like nitrate nitrogen for meeting the additional demand of host plants. Due to alteration in the nitrogen status of virus infected plants, it seems that most of the nitrate, after absorption, is translocated to the leaves as such where it is soon used up for active protein synthesis. This may be a reason for the higher activity of the enzyme in the leaves than the other plant parts.

Exposure to the lights has been found to accelerate the synthesis of nitrate nitrogen in the plants (Hageman and Flesher, 1959; Kannanagara and Woolhouse, 1967). These are the plausible reasons by which the higher activity of nitrate reductase in leaves could be explained. The low nitrate reductase activity in the roots may be due to its negatively phototropic nature. As the roots have been found to b a poor source of virus, it seems that the conversion of nitrate to nitrite is low; it was substantiated by the lower activity of enzyme in the root.

Nitrate reductase is known as inducible enzyme by its substrate, the nitrate (Hewitt and Afridi, 1959). Wallace and Pele (1965) observed that within two hours of applying nitrate to the rooting medium, nitrate reductase can be detected in both the shoot and root. A higher level of nitrate nitrogen was observed in infected pumpkin plant parts than healthy ones (Singh, 1979). The presence of higher amount of the substrate (nitrate nitrogen) in virus infected plant parts could obviously enhance the enzymatic activity.

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ÖZET

KARPUZ MOZAYIK VİRUSU İLE İNFEKTELİ KABAK BİTKİLERİNİN ENZİMATİK AKTİVİTELERİNDEKİ DEĞİŞİKLİKLER

Denemeler karpuz mozayık virusunun (WMV) bir ırkı ile infekte olmuş kabak **(Cucurbita maxima)** bitkilerindeki enzimatik aktiviteye virusun etkisini incelemek için yapılmıştır. Sonuçlar katalase aktivitesinin hem sağlam hem de WMV infekte bitkilerde bitkinin yaşlanmasıyla birlikte 60'ncı güne kadar arttığını ve ondan sonra düştüğünü ortaya koymuştur. Bununla beraber, hastalıklı yaprak örneklerinde aktivite daima sağlam kısımlarda olduğundan daha düşüktü. Maksimum katalase aktivitesi inokulasyondan sonra 60'ncı günde kaydedilmiştir. Genelde, nitrate redüktase aktivitesi WMV infekteli yaprak, gövde ve köklerde artmıştır. İnfekteli yapraklar maksimum enzim aktivitesi göstermiştir. En yüksek aktivite inokulasyondan sonraki 60'ncı günde kaydedilmiş ondan sonra düşmüştür. Enzimin aktivitesi değişken olarak bitki yaşındaki artışla beraber artmıştır.

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Investigations on Natural Control of Broomrape (**Orobanche** sp.) by **Phytomyza orobanchia** Kaltb. (Dipt., Agromyzidae) in Izmir (Turkey)

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ABSTRACT

In this study the presence of **P. orobanchia** Kaltb. (Dipt., Agromyzidae) in Izmir Province (W. Turkey), and the effectiveness of its larvae under natural condition have been reported for the first time.

Observations on 90 broomrape plants collected at random from different localities of Izmir showed that all the plants were damaged by the agromyzid. However, 843 out of 900 observed seed capsules were injured by its larvae. The percentage of damaged seed capsules was about 94 %. Moreover, **O. crenata** Forsk. infecting broad bean plants **(Vicia faba L.)** were recorded as host of the agromyzid.

INTRODUCTION

Broomrape is a serious root-parasite of many crop plants and removes their nutrient elements and water, causing approximately 30-70 % yield loss (Moiseeva et Mamraliev 1969).

Broomrape species are widespread in the semi-arid region of the world. A detailed research study on **Orobanche** species distributed in Turkey was made by Gilli (1971); regional studies were carried out by Selçuk (1966) for Aegean species of broomrape, and by Özhatay (1973) for Thrace species.

So far the studies on chemical control of **Orobanche** throughout the world have been unsatisfactory. However, studies on breeding resistant plants and biological control against broomrape seem to be more promising.

It has been reported that some fungi isolated from broomrape were useful for its biological control (Kott 1969; Stankevich 1971). The most important biological control agent against broomrapes is **Phytomyza orobanchia** Kaltb. (Dipt. Agromyzidae), especially in Yugoslavia (Lekic 1970) and in U.S.S.R. (Khlabustina, 1969; Moiseeva and

Mamraliev, 1969; Okazova, 1973).

In this study **P. orobanchia** was reported for the first time from Izmir Province (W. Turkey). However, Karasu (1966) had found it in Samsun (N. Turkey) at one locality. In the present study its damage to broomrape in field was also investigated for the first time.

MATERIALS and METHODS

P. orobanchia were found during the survey concerning **Orobanche** sp. between 15 th May and 10 th June in 1979-1980 years, in some districts of Izmir Province. During this period, generally 10 broomrape samples were collected at random from each randomlyselected broad bean (**Vicia faba** L.)fields which badly infested by broomrape. For this study, a total of 90 broomrape samples were taken from seven localities in Izmir (Table-1).

The percentage of plants damaged and undamaged by **P. orobanchia** was determined in the laboratory. Ten seed capsules were randomly harvested from each damaged plant, then damaged and undamaged seed capsules were counted. The number of puparia and larvae were determined in the total damaged seed capsules.

RESULTS and DISCUSSION

In May 1979, during the survey study, damaged broomrape plants from broad bean fields exhibited that larvae of **P. orobanchia** cause injury to this plant in Izmir Province; and that these larvae, puparia and imagos were from the first generation of the agromyzid.

In future, the observations on eggplant, tobacco and tomato fields infested by broomrape may be useful to determine the exact generation number and biology of **P. orobanchia** in Izmir Province. According to Lekic (1970), the development of a generation lasts 25-30 days and the agromyzid produces 2-4 generations per year in Yugoslavia. However, Kott (1969) reported that **P. orobanchia** produces 2-3 generations per season in Ukraine and 4-5 generations in Central Asia.

In this study, observations on **Orobanche** spp. damaged by **P. orobanchia** showed that its larvae bore and mine under the epidermis in the cortical tissue of the stem of broomrape and enter the seed capsules, damaging them before the seed matures. In addition to this, some fungi and bacteria develop in the galeries and rot the broomrape stem. Seeds cannot mature because of the severe damage to the stem even if the insect damages the seeds only slightly.

In Izmir Province, 90 broomrape plants collected at random from the different localities showed some damage by **P. orobanchia.** However, 843 seed capsules were injured by larvae of **P. orobanchia** out of 900 observed, i.e. 94 % were damaged.

In 843 damaged seed capsules, only 337 larvae and puparia were counted (Table-1). The result shows that each larva injured approximately 2-3 seed capsules.

According to the literature, under natural conditions the presence of **P. orobanchia** is in low level (Okazova, 1973), and it is necessary to mass-rearing the fly for successful control. However, in this study, it was found that, under natural conditions **P. orobanchia** affected 94 % of **Orobanche** seed capsules in infested bean fields in Izmir Province.

According to Lekic (1974) **P. orobanchia** lives mainly on **O. ramosa** and **O. cumana**; but, it uses **O. crenata** and **O. major** as secondary host plants. In this study, **P. orobanchia** were determined on **O. crenata** Forsk.

This study contains preliminary observations of effectiveness of **P. orobanchia** on broomrape under field conditions in Izmir Province. More detailed studies are needed.

Table 1. Extent of damage to broomrape plants by **Phytomyza orobanchia** in different localities of Izmir Province.

Localities (Izmir Province)	Observed Plants	Damaged Plants	Observed Capsules	Damaged Capsules	No. of Larvae	No. of Puparia	Total No. of Puparia and larvae
Menemen (Emiralem)	30	30	300	285	44	23	67
Menemen (Buruncuk)	10	10	100	88	6	27	33
Menemen (Bozköy)	10	10	100	77	9	12	21
Urla	14	14	140	139	22	31	53
Between Urla and Çeşme	6	6	60	58	11	29	40
Bergama (Zeytindağ)	10	10	100	100	—	47	47
Foça	10	10	100	96	16	60	76
Total numbers	90	90	900	843 (% 94)	108	229	337

RÉSUMÉ

Recherche sur la lutte biologique contre **Orobanche** sp. par **P. orobanchia** Kaltb. (Dipt., Agromyzidae) en İzmir (Turquie)

Dans cette recherche on a mit en evidence la présence de **P. orobanchia** Kaltb. (Dipt., Agromyzidae) dans la province d'İzmir (W. Turquie), et l'effet de leur larves sur l'orobanche au point de vue de la lutte biologique en conditions naturelle.

D'après les observations sur 90 plantes d'orobanche recoltées par hasard provenant de differentes localités d'İzmir, on a montré que tous les échantillons recoltés ont étè endomagés par ce diptère. Cependant, on a detérminé que les 843 capsules sur 900 capsules observeés, sont abimées par les larves de **P. orobanchia**; ce qui represente 94 %. En même temps on a montré que **O. crenata** Forsk. qui avait infecté les fèves **(V. faba L.)** est l'un des hôtes de **P. orobanchia.**

ZUSAMMENFASSUNG

Untersuchungen über die biologischen Bekämpfung von Orobanchen **(Orobanche** sp.) durch **Phytomyza orobanchia** Kaltb. (Dipt., Agromyzidae) in İzmir, Türkei.

In dieser Arbeit wurde das Vorkommen von **Phytomyza orobanchia** an den parasitischen Pflanze Orobanchen in İzmir (West-Türkei) erstmals berichtet und der Befall durch die Larvae von diesem Insekt unter natürlichen Bedingungen untersucht.

Beobachtungen an 90 Orobanchen, gesammelt per Zufall an den verschiedenen Standorten von Izmir, ergaben, dass alle Pflanzen durch dieses Insekt befallen waren. Von 900 untersuchten Samenkapseln waren 843 durch die Larvae geschäedigt und somit betrug der prozentuale Befall von Samenkapseln % 94.

Ausserdem wurde festgestellt, dass **Orobanche crenata** Forsk., die Ackerbohnenpflanzen parasitiert, für **P. orobanchia** als Wirtsplanze dient.

Ö Z E T

İZMİR İLİNDE CANAVAR OTU **(Orobanche** sp.)'NUN **Phytomyza orobanchia** Kaltb. (Dipt., Agromyzidae) TARAFINDAN YAPILAN DOĞAL SAVAŞI ÜZERİNDE İNCELEMELER

P. orobanchia Kaltb.'ın İzmir ilinde varlığı ve larvalarının doğal koşullarda canavar otlarında etkinliği ilk kez bu çalışma ile ortaya konmuştur.

İzmir'in farklı ilçelerinden tesa-

düf olarak toplanan 90 canavar otu üzerinde yapılan incelemeler, bu Agromizid'in incelenmiş tüm canavar otlarına zarar verdiğini göstermiştir. Ancak incelenen 900 canavar otu tohum kapsülünden 843 nün **P. orobanchia** larvaları tarafından zarar gördüğü saptanmıştır. Buna göre zarar gören kapsül % 94 oranındadır. Bunun yanında bakla bitkilerini **(Vicia faba** L.) infekte eden **O. crenata** Forsk.'nın bu Agromizidin konukçu türü olduğu da saptanmıştır.

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Erste Mitteilung

Eutypa-Absterben an Weinreben in der Türkei

E. ONOĞUR* und A. ATILA**

Eutypa armeniacae Hansford et Carter, der Erreger des Eutypa-Absterbens an Weinreben wurde in der Türkei erstmals im Mai 1982 aus der Sorte «Perlette» isoliert. Der Weinberg mit den 15 Jahre alten Reben an Drahtrahmen lag in der Naehe von İzmir, West-Türkei. Das kranke Holz trug ungewöhnlicherweise viele Triebe, die das typische Krankheitsbild Kümmerwuchs mit kleinen, deformierten, chlorotischen Blaettern besassen. Die Krankheit ging offensichtlich aus den Schnittwunden hervor. Die Verbreitung des Erregers im Holz mit braunen Zonenbildung konnte durch Quer - und Laengsschneiden des Holzes verfolgt werden. Durch die Umgürtelung des Holzes fand dann das Absterben der Arme statt. Diese Symptome stimmten überein mit denen,die aus anderen Laendern bereits berichtet wurden (BOLAY und MOLLER, 1977; MOLLER und KASIMATIS, 1978). Die endgültige Bestimmung des Pathogens wurde im Eidgenössischen Landwirtschaftlichen Forschungsanstalt, Nyon, Schweiz, durchgeführt, dem Proben aus dem kranken Holz geschickt wurden***.

Die Untersuchungen bezüglich der weiteren Isolationsversuche, der Beteiligung von anderen Pathogenen am Syndrom, vor allem von **Phomopsis viticola**, und der Befallserhebungen werden fortgeführt.

Ö Z E T

TÜRKİYE BAĞLARINDA YENİ BİR HASTALIK ETMENİ : **Eutypa armeniacae**

Bağlarda kol ve dal kurumalarına yol açabilen bir etmen olan **Eutypa armeniacae** Hansford et Carter Türkiye'de ilk olarak 1982 yılının Mayıs ayında İzmir civarında tele alınmış 15 yaşlarındaki «Perlette» çeşidi omcalarından izole edildi. Omcaların hasta kollarında alışılmışın dışında bir sürgün oluşumu gözlendi. Bu sürgünlerde gelişme geriliğine paralel olarak küçük, deforme olmuş, klorotik

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yaprakların bulunduğu dikkati çekti. Hastalığın budama yaralarından başladığı açık bir biçimde gözlendi. Dokuda oluşumuna yol açtığı kahverengi zon yardımıyla, etmenin kol içinde enine ve uzunlamasına yayılması kolayca izlendi. Kolun, hasta doku ile tamamen çevrelenmesi durumunda kuruduğu saptandı. Bu belirtilerin hastalığın simptomatolojisi ile ilgili literatürde işaret edilen belirtilere aynen uyduğu belirlendi (BOLAY ve MOLLER, 1977; MOLLER ve KASIMATIS, 1978). Hastalıklı örnekler üzerinde etmenin kesin tanısı Federal Tarımsal Araştırma Kurumu, Nyon, İsviçre'de yapıldı.

Bu konu ile ilgili olarak, izolasyon çalışmaları, hastalık belirtilerinde diğer etmenlerin, özellikle **Phomopsis viticola**'nın, katkısı ve hastalığın yayılışı üzerindeki araştırmalara devam edilmektedir.

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